THE PANAMA CANAL

Frederic J. Haskin

Altoona Pa 4/24/14
From John S Spielman
To S & H Smith

THE PANAMA CANAL

The 5 Points of Authority in this Book

1. All of the chapters in this book pertaining to the actual construction of the Canal were read and corrected by Colonel George W. Goethals, Chairman and Chief Engineer of the Isthmian Canal Commission.

2. All of the illustrations were made from photographs taken by Mr. Ernest Hallen, the official photographer of the Commission.

3. The book contains the beautiful, colored Bird's-eye View of the Canal Zone, made under the direction of the National Geographic Society, as well as the black-and-white official map of the Canal.

4. The extensive index was prepared by Mr. G. Thomas Ritchie, of the staff of the Library of Congress.

5. The final proofs were revised by Mr. Howard E. Sherman, of the Government Printing Office, to conform with the typographical style of the United States Government.

"The American Government,"

by the same author, was read by millions of Americans, and still holds the record as the world's best seller among all works of its kind.

ATLANTIC OCEAN

Courtesy, National Geographic Magazine, Washington, D. C.

BIRD'S-EYE VIEW OF THE PANAMA CANAL

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PACIFIC OCEAN

THE PANAMA CANAL

BY

FREDERIC J. HASKIN

AUTHOR OF "THE AMERICAN GOVERNMENT," ETC.

Illustrated from photographs taken by

ERNEST HALLEN

Official Photographer of the Isthmian Canal Commission

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PREFACE

The primary purpose of this book is to tell the layman the story of the Panama Canal. It is written, therefore, in the simplest manner possible, considering the technical character of the great engineering feat itself, and the involved complexities of the diplomatic history attaching to its inception and undertaking. The temptation to turn aside into the pleasant paths of the romantic history of ancient Panama has been resisted; there is no attempt to dispose of political problems that incidentally concern the canal; in short, the book is confined to the story of the canal itself, and the things that are directly and vitally connected with it.

Colonel Goethals was good enough to read and correct the chapters relating to the construction of the canal, and, when shown a list of the chapters proposed, he asked that the one headed "The Man at the Helm" be omitted. The author felt that to bow to his wishes in that matter would be to fail to tell the whole story of the canal, and so Colonel Goethals did not read that chapter.

Every American is proud of the great national achievement at Panama. If, in the case of the individual, this book is able to supplement that pride by an ample fund of knowledge and information, its object and purpose will have been attained.

ACKNOWLEDGMENTS

THE grateful acknowledgments of the author are due to Mr. William Joseph Showalter for his valuable aid in gathering and preparing the material for this book. Acknowledgments are also due to Colonel George W. Goethals, chairman and chief engineer of the Isthmian Canal Commission, for reading and correcting those chapters in the book pertaining to the engineering phases of the work; to Mr. Ernest Hallen, the official photographer of the Commission, for the photographs with which the book is illustrated; to Mr. Gilbert H. Grosvenor, editor of the *National Geographic Magazine*, for permission to use the bird's-eye view map of the canal; to Mr. G. Thomas Ritchie, of the Library of Congress, for assistance in preparing the index; and to Mr. Howard E. Sherman, of the Government Printing Office, for revising the proofs to conform with the typographical style of the United States Government.

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The Panama Canal

"I have read the chapters in 'The Panama Canal' dealing with the engineering features of the Canal and have found them an accurate and dependable account of the undertaking."

GEO. W. GOETHALS.

THE PANAMA CANAL

CHAPTER I

THE LAND DIVIDED — THE WORLD UNITED

THE Panama Canal is a waterway connecting the Atlantic and Pacific Oceans, cut through the narrow neck of land connecting the continents of North and South America. It is the solution of the problem of international commerce that became acute in 1452 when the Eastern Roman Empire fell before the assaults of the Turks, and the land routes to India were closed to Western and Christian Europe.

Forty years after the Crescent supplanted the Cross on the dome of St. Sophia in Constantinople, Columbus set sail to seek a western route to the Indies. He did not find it, but it was his fortune to set foot on the Isthmus of Panama, where, more than four centuries later, the goal of his ambition was to be achieved; not by discovery, but by virtue of the strength and wealth of a new nation of which he did not dream, although its existence is due to his own intrepid courage.

Columbus died not knowing that he had multiplied the world by two, and many voyagers after him also vainly sought the longed-for western pas-

sage. Magellan sought it thousands of leagues to the southward in the cold and stormy seas that encircle the Antarctic Continent. Scores of mariners sought it to the northward, but only one, Amundsen, in the twentieth century, was able to take a ship through the frozen passages of the American north seas.

Down the western coast of the new continent from the eternal ice of Alaska through the Tropics to the southern snows of Tierra del Fuego, the mighty Cordilleras stretch a mountain barrier thousands and thousands and thousands of miles.

Where that mountain chain is narrowest, and where its peaks are lowest, ships may now go through the Panama Canal. The canal is cut through the narrowest part of the Isthmus but one, and through the Culebra Mountain, the lowest pass but one, in all that longest, mightiest range of mountains. There is a lower place in Nicaragua, and a narrower place on the Isthmus east of the canal, but the engineers agreed that the route from Colon on the Atlantic to Panama on the Pacific through Culebra Mountain was the most practicable.

The canal is 50 miles long. Fifteen miles of it is level with the oceans, the rest is higher. Ships are lifted up in giant locks, three steps, to sail for more than 30 miles across the continental divide, 85 feet above the surface of the ocean, then let down by three other locks to sea level again. The channel is 300 feet wide at its narrowest place, and the locks which form the two gigantic water stairways are capable of lifting and lowering the largest ships now afloat. A great part of the

higher level of the canal is the largest artificial lake in the world, made by impounding the waters of the Chagres River, thus filling with water the lower levels of the section. Another part of the higher level is Culebra Cut, the channel cut through the backbone of the continent.

Almost before Columbus died plans were made for cutting such a channel. With the beginning of the nineteenth century and the introduction of steam navigation, the demand for the canal began to be insistent.

Many plans were made, but it remained for the French, on New Year's Day of 1880, actually to begin the work. They failed, but not before they had accomplished much toward the reduction of Culebra Cut. They expended between 1880 and 1904 no less than $300,000,000 in their ill-fated efforts.

In 1904 the United States of America undertook the task. In a decade it was completed and the Americans had spent, all told, $375,000,000 in the project.

Because the Atlantic lies east and the Pacific west of the United States, one is likely to imagine the canal as a huge ditch cut straight across a neck of land from east to west. But it must be remembered that South America lies eastward from North America, and that the Isthmus connecting the two has its axis east and west. The canal, therefore, is cut from the Atlantic southeastward to the Pacific. It lies directly south of Pittsburgh, Pa., and it brings Peru and Chile closer to New York than California and Oregon. The first 7 miles of the canal, beginning at the

Atlantic end, run directly south and from thence to the Pacific it pursues a serpentine course in a southeasterly direction.

At the northern, or Atlantic, terminus are the twin cities of Colon and Cristobal, Colon dating from the middle of the nineteenth century when the railroad was built across the Isthmus, and Cristobal having its beginnings with the French attempt in 1880. At the southern, or Pacific, terminus are the twin cities of Panama and Balboa. Panama was founded in 1673 after the destruction by Morgan, the buccaneer, of an elder city established in 1519. The ruins of the old city stand 5 miles east of the new, and, since their story is one, it may be said that Panama is the oldest city of the Western World. Balboa is yet in its swaddling clothes, for it is the new American town destined to be the capital of the American territory encompassing the canal.

The waterway is cut through a strip of territory called the Canal Zone, which to all intents and purposes is a territory of the United States. This zone is 10 miles wide and follows the irregular line of the canal, extending 5 miles on either side from the axis of the channel. This Canal Zone traverses and separates the territory of the Republic of Panama, which includes the whole of the Isthmus, and has an area about equal to that of Indiana and a population of 350,000 or about that of Washington City. The two chief Panaman cities, Panama and Colon, lie within the limits of the Canal Zone, but, by the treaty, they are excepted from its government and are an integral part of the Republic of Panama, of which

the city of Panama is the capital. Cristobal and Balboa, although immediately contiguous to Colon and Panama, are American towns under the American flag.

The Canal Zone historically and commercially has a record of interest and importance longer and more continuous than any other part of the New World. Columbus himself founded a settlement here at Nombre de Dios; Balboa here discovered the Pacific Ocean; across this narrow neck was transported the spoil of the devastated Empire of the Incas; here were the ports of call for the Spanish gold-carrying galleons; and here centered the activities of the pirates and buccaneers that were wont to prey on the commerce of the Spanish Main.

Over this route, on the shoulders of slaves and the back of mules, were transported the wares in trade of Spain with its colonies not only on the west coasts of the Americas, but with the Philippines.

Not far from Colon was the site of the colony of New Caledonia, the disastrous undertaking of the Scotchman, Patterson, who founded the Bank of England, to duplicate in America the enormous financial success of the East India Company in Asia.

Here in the ancient city of Panama in the early part of the nineteenth century assembled the first Pan American conference that gave life to the Monroe doctrine and ended the era of European colonization in America.

Here was built with infinite labor and terrific toll of life the first railroad connecting the Atlantic

and the Pacific Oceans — a railroad less than 50 miles in length, but with perhaps the most interesting story in the annals of railroading.

Across this barrier in '49 clambered the American argonauts, seeking the newly discovered golden fleeces of California.

This was the theater of the failure of Count de Lesseps, the most stupendous financial fiasco in the history of the world.

And this, now, is the site of the most expensive and most successful engineering project ever undertaken by human beings.

It cost the French $300,000,000 to fail at Panama where the Americans, at the expenditure of $375,000,000, succeeded. And, of the excavation done by the French, only $30,000,000 worth was available for the purpose of the Americans. That the Americans succeeded where the French had failed is not to be assigned to the superiority of the American over the French nation. The reasons are to be sought, rather, in the underlying purposes of the two undertakings, and in the scientific and engineering progress made in the double decade intervening between the time when the French failure became apparent and the Americans began their work.

In the first place, the French undertook to build the canal as a money-making proposition. People in every grade of social and industrial life in France contributed from their surpluses and from their hard-earned savings money to buy shares in the canal company in the hope that it would yield a fabulously rich return. Estimates of the costs of the undertaking, made by the engineers, were

arbitrarily cut down by financiers, with the result that repeated calls were made for more money and the shareholders soon found to their dismay that they must contribute more and yet more before they could hope for any return whatever. From the beginning to the end, the French Canal Company was concerned more with problems of promotion and finance than with engineering and excavation. As a natural result of this spirit at the head of the undertaking the whole course of the project was marred by an orgy of graft and corruption such as never had been known. Every bit of work was let out by contract, and the contractors uniformly paid corrupt tribute to high officers in the company. No watch was set on expenditures; everything bought for the canal was bought at prices too high; everything it had to sell was practically given away.

In the next place, the French were pitiably at the mercy of the diseases of the Tropics. The science of preventive medicine had not been sufficiently developed to enable the French to know that mosquitoes and filth were enemies that must be conquered and controlled before it would be possible successfully to attack the land barrier. Yellow fever and malaria killed engineers and common laborers alike. The very hospitals, which the French provided for the care of the sick, were turned into centers of infection for yellow fever, because the beds were set in pans of water which served as ideal breeding places for the death-bearing stegomyia.

In this atmosphere of lavish extravagance caused by the financial corruption, and in the continual

fear of quick and awful death, the morals of the French force were broken; there was no determined spirit of conquest; interest centered in champagne and women; the canal was neglected.

Yet, in spite of this waste, this corruption of money and morals, much of the work done by the French was of permanent value to the Americans; and without the lessons learned from their bitter experience it would have been impossible for the Americans or any other people to have completed the canal so quickly and so cheaply.

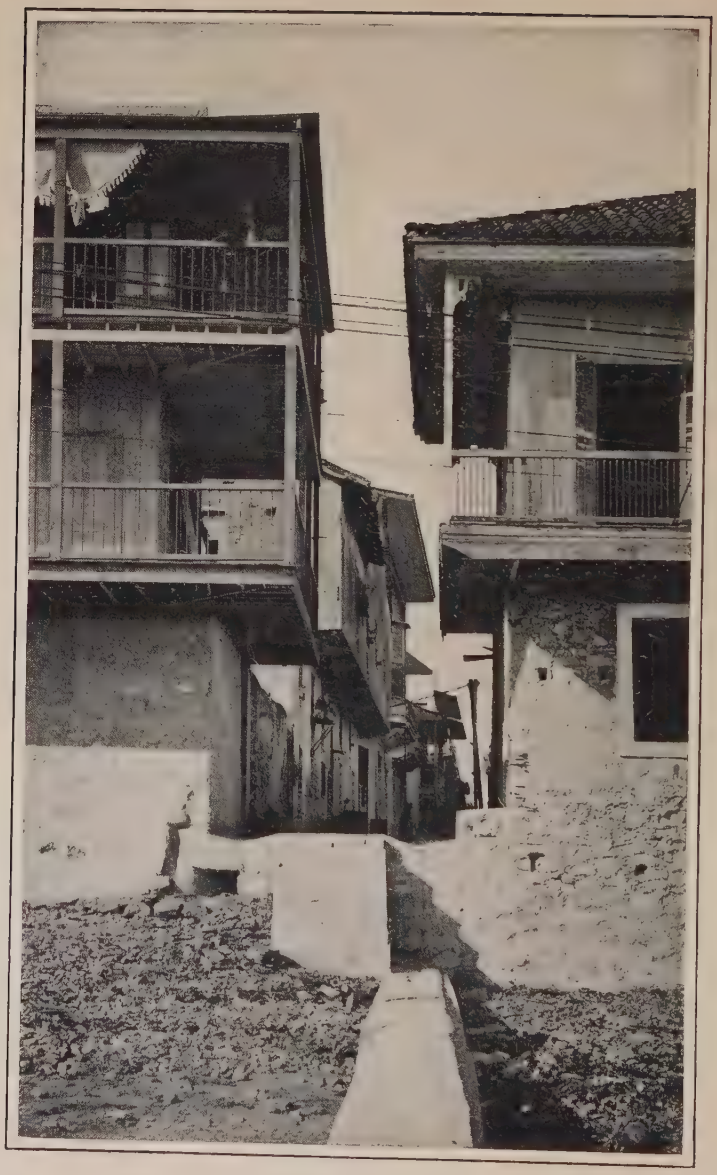
The Americans brought to the task another spirit. The canal was to be constructed not in the hope of making money, but, rather, as a great national and popular undertaking, designed to bring the two coasts of the great Republic in closer communication for purposes of commerce and defense.

The early estimates made by the American engineers were far too low, but the French experience had taught the United States to expect such an outcome. Indeed, it is doubtful if anybody believed that the first estimates would not be doubled or quadrupled before the canal was finished.

The journey of the U. S. S. *Oregon* around the Horn from Pacific waters to the theater of the War with Spain in the Caribbean, in 1898, impressed upon the American public the necessity of building the canal as a measure of national defense. Commercial interests long had been convinced of its necessity as a factor in both national and international trade, and, when it was realized that the *Oregon* would have saved 8,000 miles if there

Geo. W. Goethals

Chairman and Chief Engineer



A STREET IN THE CITY OF PANAMA

had been a canal at Panama, the American mind was made up. It determined that the canal should be built, whatever the cost.

From the very first there was never any question that the necessary money would be forthcoming. It is a fact unprecedented in all parliamentary history that all of the appropriations necessary for the construction and completion of the Isthmian waterway were made by Congress without a word of serious protest.

During the same War with Spain that convinced the United States that the canal must be built, a long forward step was taken in the science of medicine as concerned with the prevention and control of tropical diseases. The theory that yellow fever was transmitted by mosquitoes had been proved by a Cuban physician, Dr. Carlos Finley, a score of years earlier. An Englishman, Sir Patrick Manson, had first shown that disease might be transmitted by the bites of insects, and another Englishman, Maj. Roland Ross, had shown that malaria was conveyed by mosquitoes. It remained, however, for American army surgeons to demonstrate, as they did in Cuba, that yellow fever was transmissible only by mosquitoes of the stegomyia variety and by no other means whatsoever.

With this knowledge in their possession the Americans were able to do what the French were not — to control the chief enemy of mankind in torrid climes. In the first years of the work the public, and Congress, reflecting its views, were not sufficiently convinced of the efficacy of the new scientific discoveries to afford the means for put-

ting them into effect. The Isthmian Canal Commission refused to honor requisitions for wire screens, believing that they were demanded to add to the comfort and luxury of quarters on the Zone, rather than for protection against disease. But the outbreak of yellow fever in 1905 was the occasion for furnishing the Sanitary Department, under Col. W. C. Gorgas, with the necessary funds, and thus provided, he speedily and completely stamped out the epidemic. From that time on, no one questioned the part that sanitation played in the success of the project. The cities of Panama and Colon were cleaned up as never were tropical cities cleaned before. All the time, every day, men fought mosquitoes that the workers in the ditch might not be struck down at their labors.

The Americans, too, made mistakes. In the beginning they attempted to build the canal under the direction of a commission with headquarters in Washington. This commission, at long distance and by methods hopelessly involved in red tape, sought to direct the activities of the engineer in charge on the Isthmus. The public also was impatient with the long time required for preparation and insistently demanded that "the dirt begin to fly."

The work was begun in 1904. It proceeded so slowly that two years later the chairman of the Isthmian Canal Commission asserted that it must be let out to a private contractor, this being, in his opinion, the only way possible to escape the toils of governmental red tape. The then chief engineer, the second man who had held that position while fretting under these methods, was opposed

to the contract system. Bids were asked for, however, but all of them were rejected.

Fortunately, Congress from the beginning had left the President a practically free hand in directing the course of the project. Mr. Roosevelt reorganized the commission, made Col. George W. Goethals, an Army engineer, chairman of the commission and chief engineer of the canal. The constitution of the commission was so changed as to leave all the power in the hands of the chairman and to lay all of the responsibility upon his shoulders.

It was a master stroke of policy, and the event proved the choice of the man to be admirable in every way. From the day the Army engineers took charge there was never any more delay, never any halt in progress, and the only difficulties encountered were those of resistant Nature (such as the slides in Culebra Cut) and those of misinformed public opinion (such as the absurd criticism of the Gatun Dam).

The Americans, too, in the early stages of the work were hampered by reason of the fact that the final decision as to whether to build a sea-level canal or a lock canal was so long delayed by the conflicting views of the partisans of each type in Congress, in the executive branches of the Government, and among the engineers. This problem, too, was solved by Mr. Roosevelt. He boldly set aside the opinion of the majority of the engineers who had been called in consultation on the problem, and directed the construction of a lock canal. The wisdom of this decision has been so overwhelmingly demonstrated that the con-

troversy that once raged so furiously now seems to have been but a tiny tempest in an insignificant teapot.

One other feature of the course of events under the American régime at Panama must be considered. Graft and corruption had ruined the French; the Americans were determined that whether they succeeded or not, there should be no scandal. This, indeed, in part explains why there was so much apparently useless circumlocution in the early stages of the project. Congress, the President, the engineers, all who were in responsible position, were determined that there should be no graft. There was none.

Not only were the Americans determined that the money voted for the canal should be honestly and economically expended, but they were determined, also, that the workers on the canal should be well paid and well cared for. To this end they paid not only higher wages than were current at home for the same work, but they effectively shielded the workers from the exactions and extortions of Latin and Oriental merchants by establishing a commissary through which the employees were furnished wholesome food at reasonable prices — prices lower, indeed, than those prevailing at home.

As a result of these things the spirit of the Americans on the Canal Zone, from the chairman and chief engineer down to the actual diggers, was that of a determination to lay the barrier low, and to complete the job well within the limit of time and at the lowest possible cost. In this spirit all Americans should rejoice, for it is the

highest expression of the nearest approach we have made to the ideals upon which the Fathers founded our Republic.

It is impossible to leave out of the reckoning, in telling the story of the canal, the checkered history of the diplomatic engagements on the part of the United States, that have served both to help and to hinder the undertaking. What is now the Republic of Panama has been, for the greater part of the time since continental Latin America threw off the yoke of Spain, a part of that Republic having its capital at Bogota, now under the name of Colombia, sometimes under the name of New Granada, sometimes a part of a federation including Venezuela and Ecuador. The United States, by virtue of the Monroe doctrine, always asserted a vague and undefined interest in the local affairs of the Isthmus. This was translated into a concrete interest when, in 1846, a treaty was made, covering the construction of the railroad across the Isthmus, the United States engaging always to keep the transit free and open. Great Britain, by virtue of small territorial holdings in Central America and of larger claims there, also had a concrete interest, which was acknowledged by the United States, in the Clayton-Bulwer treaty of 1850, under which a projected canal should be neutral under the guarantee of the Governments of the United States and Great Britain.

For years the United States was inclined to favor a canal cut through Nicaragua, rather than one at Panama, and, after 1898, when the American nation had made up its mind to build a canal some-

where, the partisans of the Panama and Nicaragua routes waged a bitter controversy.

Congress finally decided the issue by giving the President authority to construct a canal at Panama, with the proviso that should he be unable to negotiate a satisfactory treaty with Colombia, which then owned the Isthmus, he should proceed to construct the canal through Nicaragua. Under this threat of having the scepter of commercial power depart forever from Panama, Colombia negotiated a treaty, known as the Hay-Herran treaty, giving the United States the right to construct the canal. This treaty, however, failed of ratification by the Colombian Congress, with the connivance of the very Colombian President who had negotiated it.

But President Roosevelt was most unwilling to accept the alternative given him by Congress — that of undertaking the canal at Nicaragua — and this unwillingness, to say the least, encouraged a revolution in Panama. This revolution separated the Isthmus from the Republic of Colombia, and set up the new Republic of Panama. As a matter of fact, Panama had had but the slenderest relations with the Bogota Government, had been for years in the past an independent State, had never ceased to assert its own sovereignty, and had been, indeed, the theater of innumerable revolutions.

The part the United States played in encouraging this revolution, the fact that the United States authorities prevented the transit of Colombian troops over the Panama Railway, and that American marines were landed at the time, has led to

no end of hostile criticism, not to speak of the still pending and unsettled claims made by Colombia against the United States. Mr. Roosevelt himself, years after the event and in a moment of frankness, declared: "I took Panama, and left Congress to debate it later."

Whatever may be the final outcome of our controversy with Colombia, it may be confidently predicted that history will justify the coup d' état on the theory that Panama was the best possible site for the interoceanic canal, and that the rupture of relations between the territory of the Isthmus and the Colombian Republic was the best possible solution of a confused and tangled problem.

These diplomatic entanglements, however, as the canal is completed, leave two international disputes unsettled — the one with Colombia about the genesis of the canal undertaking, and the other with Great Britain about the terms of its operation.

Congress, in its wisdom, saw fit to exempt American vessels engaged exclusively in coastwise trade — that is to say, in trade solely between ports of the United States — from payment of tolls in transit through the canal. This exemption was protested by Great Britain on the ground that the Hay-Pauncefote treaty, which took the place of the Clayton-Bulwer treaty, provided that the canal should be open to all nations on exact and equal terms. The future holds the termination of both these disputes.

Congress, that never begrudged an appropriation, indulged in many disputes concerning the

building and operation of the canal. First, there was the controversy as to site, between Nicaragua and Panama. Next, came the question as to whether the canal should be at sea level or of a lock type. Then there was the question of tolls, and the exemption of American coastwise traffic. But, perhaps the most acrimonious debates were on the question as to whether or not the canal should be fortified. Those who favored fortification won their victory, and the canal was made, from a military standpoint, a very Gibraltar for the American defense of, and control over, the Caribbean. That this was inevitable was assured by two facts: One that the trip of the *Oregon* in 1898 crystallized public sentiment in favor of constructing the canal; and the other that the canal itself was wrought by Army engineers under the direction of Colonel Goethals. Colonel Goethals never for a moment considered the possibility that Congress would vote against fortifications, and the whole undertaking was carried forward on that basis.

If the military idea, the notion of its necessity as a feature of the national defense, was the determining factor in initiating the canal project, it remains a fact that its chief use will be commercial, and that its money return, whether small or large, nearly all will be derived from tolls assessed upon merchant vessels passing through it.

The question of the probable traffic the canal will be called upon to handle was studied as perhaps no other world-wide problem of transportation ever was. Prof. Emory R. Johnson was the student of this phase of the question from

THE THREE PRESIDENTS UNDER WHOSE DIRECTION THE CANAL WAS BUILT

VENDERS IN THE STREETS OF PANAMA

A NATIVE BOY MARKETING

the beginning to the end. He estimates that the canal in the first few years of its operation will have a traffic of 10,000,000 tons of shipping each year, and that by 1975 this will have increased to 80,000,000 tons, the full capacity of the canal in its present form. Provision has been made against this contingency by the engineers who have so constructed the canal that a third set of locks at each end may be constructed at a cost of about $25,000,000, and these will be sufficient almost to double the present ultimate capacity, and to take care of a larger volume of traffic than now can be foreseen.

Americans are interested, first of all, in what the canal will do for their own domestic trade. It brings Seattle 7,800 miles nearer to New York; San Francisco, 8,800 miles nearer to New Orleans; Honolulu 6,600 miles nearer to New York than by the Strait of Magellan. Such saving in distance for water-borne freight works a great economy, and inevitably must have a tremendous effect upon transcontinental American commerce.

In foreign commerce, also, some of the distances saved are tremendous. For instance, Guayaquil, in Ecuador, is 7,400 miles nearer to New York by the canal than by the Strait of Magellan; Yokohama is nearly 4,000 miles nearer to New York by Panama than by Suez; and Melbourne is 1,300 miles closer to Liverpool by Panama than by either Suez or the Cape of Good Hope. Curiously enough, the distance from Manila to New York, by way of Suez and Panama, is almost the same, the difference in favor of Panama being only 41 miles out of a total of 11,548 miles. The

difference in distance from Hongkong to New York by the two canals is even less, being only 18 miles, this slight advantage favoring Suez.

But it is not by measure of distances that the effect of the canal on international commerce may be measured. It spells the development of the all but untouched western coast of South America and Mexico. It means a tremendous up-building of foreign commerce in our own Mississippi Valley and Gulf States. It means an unprecedented commercial and industrial awakening in the States of our Pacific coast and the Provinces of Western Canada.

While it was not projected as a money-making proposition, it will pay for its maintenance and a slight return upon the money invested from the beginning, and in a score of years will be not only self-supporting, but will yield a sufficient income to provide for the amortization of its capital in a hundred years.

The story of how this titanic work was undertaken, of how it progressed, and of how it was crowned with success, is a story without a parallel in the annals of man. The canal itself, as Ambassador Bryce has said, is the greatest liberty man has ever taken with nature.

Its digging was a steady and progressive victory over sullen and resistant nature. The ditch through Culebra Mountain was eaten out by huge steam shovels of such mechanical perfection that they seemed almost to be alive, almost to know what they were doing. The rocks and earth they bit out of the mountain side were carried away by trains operating in a system of

such skill that it is the admiration of all the transportation world, for the problem of disposing of the excavated material was even greater than that of taking it out.

The control of the torrential Chagres River by the Gatun Dam, changing the river from the chief menace of the canal to its essential and salient feature, was no less an undertaking. And, long after Gatun Dam and Culebra Cut cease to be marvels, long after the Panama Canal becomes as much a matter of course as the Suez Canal, men still will be thrilled and impressed by the wonderful machinery of the locks — those great water stairways, operated by machinery as ingenious as gigantic, and holding in check with their mighty gates such floods as never elsewhere have been impounded.

It is a wonderful story that this book is undertaking to tell. There will be much in it of engineering feats and accomplishments, because its subject is the greatest of all engineering accomplishments. There will be much in it of the things that were done at Panama during the period of construction, for never were such things done before. There will be much in it of the history of how and why the American Government came to undertake the work, for nothing is of greater importance. There will be something in it of the future, looking with conservatism and care as far ahead as may be, to outline what the completion of this canal will mean not only for the people of the United States, but for the people of all the world.

Much that might be written of the romantic

history of the Isthmian territory — tales of discoverers and conquistadores, wild tales of pirates and buccaneers, serio-comic narratives of intrigue and revolution — is left out of this book, because, while it is interesting, it now belongs to that antiquity which boasts of many, many books; and this volume is to tell not of Panama, but of the Panama Canal — on the threshold of its story, fitted by a noble birth for a noble destiny.

CHAPTER II

GREATEST ENGINEERING PROJECT

THE Panama Canal is the greatest engineering project of all history. There is more than the patriotic prejudice of a people proud of their own achievements behind this assertion. Men of all nations concede it without question, and felicitate the United States upon the remarkable success with which it has been carried out. So distinguished an authority as the Rt. Hon. James Bryce, late British ambassador to Washington, and a man not less famous in the world of letters than successful in the field of diplomacy, declared before the National Geographic Society that not only is the Panama Canal the greatest undertaking of the past or the present but that even the future seems destined never to offer any land-dividing, world-uniting project comparable to it in magnitude or consequence.

We are told that the excavations total 232,000,000 cubic yards; that the Gatun Dam contains 21,000,000 cubic yards of material; and that the locks and spillways required the laying of some 4,500,000 cubic yards of concrete. But if one is to realize the meaning of this he must get out of the realm of cubic yards and into the region of concrete comparisons. Every one is familiar with the size and shape of the Washington Monu-

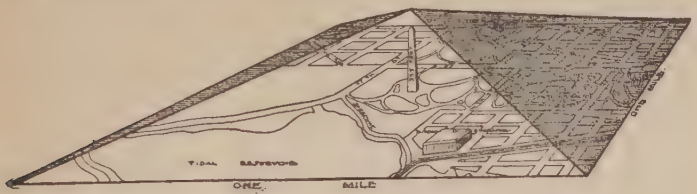
ment. With its base of 55 feet square and its height of 555 feet, it is one of the most imposing of all the hand reared structures of the earth. Yet the material excavated from the big waterway at Panama represents 5,840 such solid-built shafts. Placed in a row with base touching base they would traverse the entire Isthmus and reach 10 miles beyond deep water in the two oceans at Panama. Placed in a square with base touching base they would cover an area of 475 acres. If all the material were placed in one solid shaft with a base as large as the average city block, it would tower nearly 100,000 feet in the air.

Another illustration of the magnitude of the quantity of material excavated at Panama may be had from a comparison with the pyramid of Cheops, of which noble pile some one has said that "All things fear Time, but Time fears only Cheops." We are told that it required a hundred thousand men 10 years to make ready for the building of that great structure, and 20 years more to build it. There were times at Panama when, in 26 working days, more material was removed from the canal than was required to build Cheops, and from first to last the Americans removed material enough to build sixty-odd pyramids such as Cheops. Were it all placed in one such structure, with a base as large as that of Cheops, the apex would tower higher into the sky than the loftiest mountain on the face of the earth.

Still another way of arriving at a true conception of the work of digging the big waterway is to consider that enough material had to be removed by the Americans to make a tunnel

through the earth at the equator more than 12 feet square.

But perhaps the comparison that will best illustrate the immensity of the task of digging the ditch is that of the big Lidgerwood dirt car,



A GRAPHIC REPRESENTATION OF THE MATERIAL HANDLED AT PANAMA

on which so much of the spoil has been hauled away. Each car holds about 20 cubic yards of dirt, and 21 cars make a train. The material removed from the canal would fill a string of these cars reaching about three and a half times around the earth, and it would take a string of Panama Railroad engines reaching almost from New York to Honolulu to move them.

Yet all these comparisons have taken account of the excavations only. The construction of the Panama Canal represents much besides digging a ditch, for there were some immense structures to erect. Principal among these, so far as magnitude is concerned, was the Gatun Dam, that big ridge of earth a mile and a half long, half a mile thick at the base, and 105 feet high. It contains some 21,000,000 cubic yards of material, enough to build more than 500 solid shafts like the Washington Monument. Then there was the dam at Pedro Miguel — "Peter Magill,"

as the irreverent boys of Panama christened it — and another at Miraflores, each of them small in comparison with the great embankment at Gatun, but together containing as much material as 70 solid shafts like our Washington Monument.

Besides these structures there still remain the locks and spillways, with their four and a half million cubic yards of concrete and their hundreds and thousands of tons of steel.

With all these astonishing comparisons in mind, is it strange that the digging of the Panama Canal is the world's greatest engineering project? Are they not enough to stamp it as the greatest single achievement in human history? Yet even they, pregnant of meaning as they are, fail to reveal the full and true proportions of the work of our illustrious army of canal diggers. They tell nothing of the difficulties which were overcome — difficulties before which the bravest spirit might have quailed.

When the engineers laid out the present project, they calculated that 103,000,000 cubic yards of material would have to be excavated, and predicted that the canal diggers would remove that much in nine years. Since that time the amount of material to be taken out has increased from one cause or another until it now stands at more than double the original estimate. At one time there was an increase for widening the Culebra Cut by 50 per cent. At another time there was an increase to take care of the 225 acres of slides that were pouring into the big ditch like glaciers. At still another time there was an increase for the creation of a small lake between the locks at

Pedro Miguel and Miraflores. At yet another time it was found that the Chagres River and the currents of the Atlantic and the Pacific Oceans were depositing large quantities of silt and mud in the canal, and this again raised the total amount of material to be excavated. But none of these unforeseen obstacles and additional burdens dismayed the engineers. They simply attacked their problem with renewed zeal and quickened energy, with the result that they excavated in seven years of actual operations more than twice as much material as they were expected to excavate in nine years. In other words, the material to be removed was increased 125 per cent and yet the canal was opened at least 12 months ahead of the time predicted.

How this unprecedented efficiency was developed forms in itself a remarkable story of achievement. The engineers met with insistent demands that they "make the dirt fly." The people had seen many months of preparation, but they had no patience with that; they wanted to see the ditch begin to deepen. It was a critical stage in the history of the project. If the dirt should fail to fly public sentiment would turn away from the canal.

So John F. Stevens addressed himself to making it fly. Before he left he had brought the monthly output almost up to the million yard mark. When that mark was passed the President of the United States, on behalf of himself and the nation, sent a congratulatory message to the canal army. Many people asserted that it was nothing but a burst of speed; but the canal diggers squared

themselves for a still higher record. They forced up the mark to two million a month, and straightway used that as a rallying point from which to charge the heights three million. Once again the standard was raised; "four million" became the slogan. Wherever that slogan was flashed upon a Y. M. C. A. stereoptican screen there was cheering — cheering that expressed a determined purpose. Finally, when March, 1909, came around all hands went to work with set jaws, and for the only time in the history of the world there was excavated on a single project, 4,000,000 cubic yards of material in one month.

With the dirt moving, came the question of the cost of making it fly. By eliminating a bit of lost motion here and taking up a bit of waste there, even with the price of skilled labor fully 50 per cent higher on the Isthmus than in the States, unit costs were sent down to surprisingly low levels. For instance, in 1908 it was costing $11\frac{1}{2}$ cents a cubic yard to operate a steam shovel; in 1911 this had been forced down to $8\frac{7}{8}$ cents a yard. In 1908 more than $18\frac{1}{2}$ cents were expended to haul a cubic yard of spoil 8 miles; in 1911 a cubic yard was hauled 12 miles for a little more than $15\frac{1}{5}$ cents.

Some of the efficiency results were astonishing. To illustrate: One would think that the working power of a ton of dynamite would be as great at one time as another; and yet the average ton of dynamite in 1911 did just twice as much work as in 1908. No less than $50,000 a month was saved by shaking out cement bags.

It was this wonderful efficiency that enabled

the United States to build the canal for $375,000,000 when without it the cost might have reached $600,000,000. In 1908, after the army had been going at regulation double-quick for a year, a board was appointed to estimate just how much material would have to be taken out, and how much it would cost. That board estimated that the project as then planned would require the excavation of 135,000,000 cubic yards of material, and that the total cost of the canal as then contemplated would be $375,000,000. Also it was estimated that the canal would be completed by January 1, 1915. After that time the amount of material to be excavated was increased by 97,000,000 cubic yards, and yet so great was the efficiency developed that the savings effected permitted that great excess of material to be removed without the additional expense of a single penny above the estimates of 1908, and in less time than was forecast.

Although the difficulties that beset the canal diggers were such as engineers never before encountered, they were met and brushed aside, and all the world's engineering records were smashed into smithereens. It required 20 years to build the Suez Canal, through a comparatively dry and sandy region. When the work at Panama was at its height the United States was excavating the equivalent of a Suez Canal every 15 months. Likewise it required many years to complete the Manchester Ship Canal between Liverpool and Manchester, a distance of 35 miles. This canal cost so much more than was estimated that money was raised for its completion only with the greatest

difficulty. Yet at Panama the Americans dug four duplicates of the Manchester Ship Canal in five years. All of this was done in spite of the fact that they had to work in a moist, hot, enervating climate where for nine months in a year the air seems filled with moisture to the point of saturation, and where, for more than half the length of the great ditch, the annual rainfall often amounts to as much as 10 feet — all of this falling in the nine months of the wet season.

A few comparisons outside of the construction itself will serve to illustrate the tremendous proportions of the work. Paper money was not handled at all in paying off the canal army. It took three days to pay off the force with American gold and Panaman silver. When pay day was over there had been given into the hands of the Americans, and thrown into the hats of the Spaniards and West Indian negroes, 1,600 pounds of gold and 24 tons of silver. When it is remembered that this performance was repeated every month for seven years, one may imagine the enormous outlay of money for labor.

The commissary also illustrates the magnitude of the work. Five million loaves of bread, a hundred thousand pounds of cheese, more than 9,000,000 pounds of meat, half a million pounds of poultry, more than a thousand carloads of ice, more than a million pounds of onions, half a million pounds of butter — these are some of the items handled in a single year.

Wherever one turns he finds things which furnish collateral evidence of the magnitude of the work. The Sanitary Department used each year

150,000 gallons of mosquito oil, distributed thousands of pounds of quinine, cut and burned millions of square yards of brush, and spent half a million dollars for hospital maintenance.

No other great engineering project has allowed such a remarkable "margin of safety" — the engineering term for doing things better than they need to be done. The engineers who dug the canal took nothing for granted. No rule of physics was so plain or so obvious as to escape actual physical proof before its acceptance, when such proof was possible. No one who knows how the engineers approached the subject, how they resolved every doubt on the side of safety, and how they kept so far away from the danger line as actually to make their precaution seem excessive can doubt that the Panama Canal will go down in history as the most thorough as well as the most extensive piece of engineering in the world.

CHAPTER III

GATUN DAM

THE key to the whole Panama Canal is Gatun Dam, that great mass of earth that impounds the waters of the Chagres River, makes of the central portion of the canal a great navigable lake with its surface 85 feet above the level of the sea, and, in short, renders practicable the operation of a lock type of canal across the Isthmus.

Around no other structure in the history of engineering did the fires of controversy rage so furiously and so persistently as they raged for several years around Gatun Dam. It was attacked on this side and that; its foundations were pronounced bad and its superstructure not watertight. Doubt as to the stability of such a structure led some of the members of the Board of Consulting Engineers to recommend a sea-level canal. Further examination of the site and experimentation with the materials of which it was proposed to construct it, showed the engineers that it was safe as to site and satisfactory as to superstructure. The country had about accepted their conclusions, when, in the fall of 1908, there was a very heavy rain on the Isthmus, and some stone which had been deposited on the soil on the upstream toe of the dam, sank out of sight — just as the engineers

expected it to do. A story thereupon was sent to the States announcing that the Gatun Dam had given way and that the Chagres River was rushing unrestrained through it to the sea. The public never stopped to recall that the dam was not yet there to give way, or to inquire exactly what had happened, and a wave of public distrust swept over the country.

To make absolutely certain that everything was all right, and to restore the confidence of the people in the big project, President Roosevelt selected the best board of engineers he could find and sent them to the Isthmus in company with President-elect Taft to see exactly what was the situation at Gatun.

They examined the site, they examined the material, they examined the evidence in Colonel Goethal's hands. When they got through they announced that they had only one serious criticism to make of the dam as proposed. "It is not necessary to tie a horse with a log chain to make sure he can not break away," observed one of them, "a smaller chain would serve just as well." And so they recommended that the crest of the dam be lowered from 135 feet to 115 feet. Still later this was cut to 105 feet. They found that the underground river whose existence was urged by all who opposed a lock canal, flowed nowhere save in the fertile valleys of imagination. The engineers had known this a long time, but out of deference to the doubters they had decided to drive a lot of interlocking sheet piling across the Chagres Valley. "What's the use trying to stop a river that does not exist?" queried the engineers, and so the sheet piling was omitted.

As a matter of fact, Gatun Dam proved the happiest surprise of the whole waterway. In every particular it more than fulfilled the most optimistic prophecies of the engineers. They said that what little seepage there would be would not hurt anything; the dam answered by showing no seepage at all. They said that the hydraulic core would be practically impervious; it proved absolutely so. Where it was once believed that Gatun Dam would be the hardest task on the Isthmus it proved to be the easiest. Culebra Cut exchanged places with it in that regard.

Gatun Dam contains nearly 22,000,000 cubic yards of material. Assuming that it takes two horses to pull a cubic yard of material it would require twice as many horses as there are in the United States to move the dam were it put on wheels. Loaded into ordinary two-horse dirt wagons it would make a procession of them some 80,000 miles long. The dam is a mile and a half long, a half mile thick at the base, 300 feet thick at the water line, and 100 feet thick at the crest. Its height is 105 feet.

Yet in spite of its vast dimensions it is the most inconspicuous object in the landscape. Grown over with dense tropical vegetation it looks little more conspicuous than a gradual rise in the surface of the earth. Passengers passing Gatun on the Panama Railroad scarcely recognize the dam as such when they see it, so gradual are its slopes. An excellent idea of the gentle incline of the dam may be had by referring to the accompanying figure, which shows the outlines of a cross section of the dam.

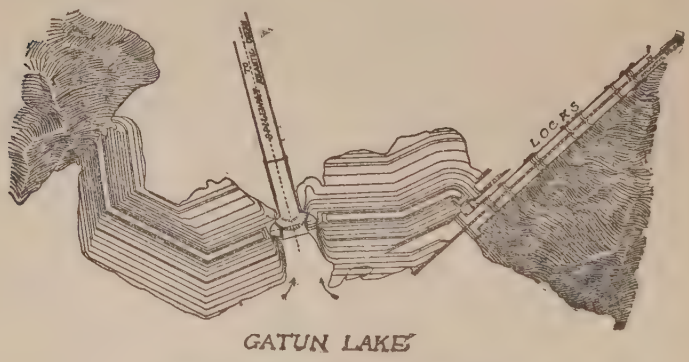
The materials of which it is constructed are also shown there. Starting on the upstream side there is a section made of solid material from Culebra Cut. Beyond this is the upstream toe of the dam, which is made of the best rock in the

A CROSS-SECTION OF THE GATUN DAM

Culebra Cut. After this comes the hydraulic fill. This material is a mixture of sand and clay which, when it dries out thoroughly, is compact and absolutely impervious to water. It was secured from the river channel and pumped with great 20-inch centrifugal pumps into the central portion of the dam, where a veritable pond was formed; the heavier materials settled to the bottom, forming layer after layer of the core, while the lighter particles, together with the water, passed off through drain pipes. In this way the water was not only the hod carrier of the dam construction, but the stone mason as well. Where there was the tiniest open space, even between two grains of sand, the water found it and slipped in as many small particles as were necessary to stop it up.

Above the hydraulic fill on the upstream side is a layer of solid material, while that part of the face of the dam exposed to wave action is covered with heavy rock. The same is true of the crest. On the downstream half of the dam there is approximately 400 feet of hydraulic fill, then 400 feet of solid fill, then a 30-foot toe, and then ordinary excavated material.

The Chagres Valley is a wide one until it reaches Gatun. Here it narrows down to a mile and a half. It is across this valley that the Gatun Dam is thrown in opposition to the seaward journey of the Chagres waters. At the halfway point across the valley there was a little hill almost entirely of solid rock. It happened to be planted exactly at the place the engineers needed it. Here they could erect their spillway for the control of the water in the lake above.



PLAN OF THE GATUN DAM AND LOCKS

The regulation of the water level in Gatun Lake is no small task, for the Chagres is one of the world's moodiest streams. At times it is a peaceful, leisurely stream of some 2 feet in depth, while at other times it becomes a wild, roaring, torrential river of magnificent proportions. Sometimes it reaches such high stages that it sends a million gallons of water to the sea between the ticks of a clock.

In controlling the Chagres, the engineers again

took what on any private work would have been regarded as absurd precaution. In the first place, Gatun Lake will be so big that the Chagres can break every record it heretofore has set, both for momentary high water and for sustained high water, and still, with no water being let out of the lake, it can continue to flow that way for a day and a half without disturbing things at all. It could flow for two days before any serious damage could be done. Thus the canal force might be off duty for some 45 hours, with the outlet closed, before any really serious damage could be done by the rampage of the river.

But of course no one supposes that it would be humanly possible that two such contingencies as the highest water ever known, and everybody asleep at their posts for two days, could happen together. When the water in the lake reached its normal level of 87 feet the spillway gates would be opened, and, if necessary, it would begin to discharge 145,000 feet of water a second. This is 17,000 feet more than the record for sustained flow heretofore set by the Chagres. But if it were found that even this was inadequate the culverts in the locks could be brought into play, and with them the full discharge would be brought up to 194,000 feet a second, or 57,000 more than the Chagres has ever brought down. But suppose even this would not suffice to take care of the floods of the Chagres? The spillway is so arranged that as the level of the water in the lake rises the discharging capacity increases. With the spillway open, even if the Chagres were to double its record for continued high water, it would take

many days to bring the lake level up to the danger point — 92 feet. When it reached that height the spillway would have a capacity of 222,000 feet, which, with the aid of the big lock culverts, would bring the total discharge up to 262,000 feet a second — only 12,000 cubic feet less than double the highest known flow of the Chagres.

But this is only characteristic of what one sees everywhere. Whether it be in making a spillway that would accommodate two rivers like the Chagres instead of one, or in building dams with 63 pounds of weight for every pound of pressure against it, or yet in building lock gates which will bear several times the maximum weight that can ever be brought against them, the work at Panama was done with the intent to provide against every possible contingency.

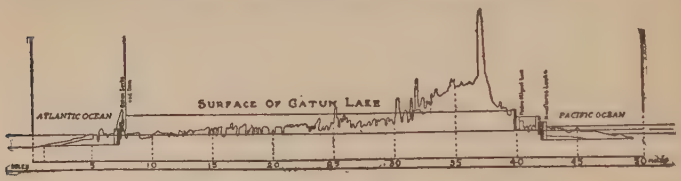
The spillway through which the surplus waters of Gatun Lake will be let down to the sea level, is a large semicircular concrete dam structure with the outside curve upstream and the inside curve downstream. Projecting above the dam are 13 piers and 2 abutments, which divide it into 14 openings, each of them 45 feet wide. These openings are closed by huge steel gates, 45 feet wide, 20 feet high, and weighing 42 tons each. They are mounted on roller bearings, suspended from above, and are operated by electricity. They work in huge frames just as a window slides up and down in its frame. Each gate is independent of the others, and the amount of water permitted to go over the spillway dam thus can be regulated at will.

When a huge volume of water like a million

gallons a second is to be let down a distance of about 60 feet, it may be imagined that unless some means are found to hold it back and let it descend easily, by the time it would reach the bottom it would be transformed into a thousand furies of energy. Therefore, the spillway dam has been made semicircular, with the outside lines pointing up into the lake and the inside lines downstream, so that as the water runs through the openings it will converge all the currents and cause them to collide on the apron below. This largely overcomes the madness of the water. But still further to neutralize its force and to make it harmless as it flows on its downward course, there are two rows of baffle piers on the apron of the spillway. They are about 10 feet high and are built of reinforced concrete, with huge cast-iron blocks upon their upstream faces. When the water gets through them it has been tamed and robbed of all its dangerous force. The spillway is so constructed that when the water flowing over it becomes more than 6 feet deep it adheres to the downstream face of the dam as it glides down, instead of rushing out and falling perpendicularly.

The locks are situated against the high hills at the east side of the valley, after which comes the east wing of the dam, then the spillway, then the west wing of the dam, which terminates on the side of the low mountain that skirts the western side of the valley. With the hills bordering the valley and the dam across it, the engineers have been able to inclose a gigantic reservoir which has a superficial surface of 164 square miles. It is irregular in shape and might remind one of a

pressed chrysanthemum, the flower representing the lake and the stem Culebra Cut. The surface of the water in this lake is normally 85 feet higher than the surface of the water seaward from Gatun and Miraflores. The lake is entirely fresh water supplied by the Chagres River. The accompanying figure shows the profile of the canal.



A PROFILE SECTION OF THE CANAL

The Chagres River approaches the canal at approximately right angles at Gamboa, some 21 miles above Gatun. The lake will be so large that the river currents will all be absorbed, the water backing far up into the Chagres, the river depositing its silt before it reaches the canal proper.

With the currents thus checked, the Chagres will lose all power to interfere with the navigation of the canal, although upon the bosom of its water will travel for a distance of 35 miles all the ships that pass through the big waterway from Gatun to Miraflores. This fresh water will serve a useful purpose besides carrying ships over the backbone of the continent. Barnacles lose their clinging power in fresh water, and when a ship passes up through the locks from sea level to lake level and from salt water to fresh, the barnacles that have clung to the sides and bottom of the vessel through many a thousand mile of "sky-hooting through

the brine" will have their grip broken and they will drop off helplessly and fall to the bed of the lake, which, in the course of years, will become barnacle-paved. How many times in dry-dock this will save can only be surmised, but the ship that goes through the canal regularly will not have much bother with barnacles.

The engineer who worked out the details of the engineering examination of the dam in 1908 was Caleb M. Saville, who had had experience on some of the greatest dams in the world. In the first place, the whole foundation was honeycombed with test borings, and several shafts were sunk so that the engineers could go down and see for themselves exactly what was the nature of the material below. There are some problems in engineering where a decision is so close between safety and danger that none but an engineer can decide them. But Gatun Dam could speak for itself and in the layman's tongue.

After investigating the site and getting such conclusive evidence that the proverbial wayfaring man might understand it the engineers next conducted a series of experiments to determine whether or not the material of which they proposed to build the dam would be watertight. They wanted to make sure whether enough water would seep through to carry any of the dam material along with it. The maximum normal depth of the water is 85 feet. The material it would have to seep through is nearly a half mile thick. In order to determine how the water would behave they took some 3 feet of the material and put it in a strong iron cylinder with water

above it and subjected it to a pressure equivalent to a head of 185 feet of water. Only an occasional drop came through. If only an occasional drop of clear water gets through 3 feet of material under a pressure of 185 feet of water, it does not require a great engineer to determine that there will not be any seepage through more than a thousand feet of the same material under a head of only 85 feet.

And that is only a sample of their seeking after the truth. When they had gone thus far it was then decided to build a little dam a few yards long identical in cross section with Gatun Dam. It was built on the scale of an inch to the foot, by the identical processes with which it was intended to build the big dam. The result only added confirmation to the other experiments. With a proportionate head of water against it, it behaved exactly as they had concluded the big dam would when completed. Every engineer who has read Saville's report pronounces it a masterpiece of engineering investigation. It proved conclusively that the site of the dam is stable, and the dam itself impervious to seepage. The engineers who visited the Isthmus at the time with President-elect Taft unanimously agreed that those investigations removed every trace of doubt.

The Gatun Dam covers about 288 acres. The material in it weighs nearly 30,000,000 tons. The pressure of the highest part of the dam on the foundations beneath amounts to many tons per square foot. The old bugaboo about earthquakes throwing it down is a danger that exists only in the minds of those who see ghosts. Some of the

biggest earth dams in the world are located in California. The Contra Costa Water Company's dam at San Leandro is 120 feet high and not nearly so immense in its proportions as Gatun Dam, yet it weathered the San Francisco earthquake without difficulty. In Panama City there is an old flat arch that once was a part of a church. It looks as though one might throw it down with a golf stick, and yet it has stood there for several centuries. As a matter of fact, Panama is out of the line of earthquakes and volcanoes, but even if shocks much worse than those at San Francisco were to come, there is no reason to fear for the safety of the big structure.

The lack of knowledge of some of those who in years past criticized the Gatun Dam was illustrated by an amusing incident that occurred at a senatorial hearing on the Isthmus. Philander C. Knox, afterwards Secretary of State, was then a Senator and a member of the committee which went to the Isthmus. Another Senator in the party had grave doubts about the stability of Gatun Dam, and asked Colonel Goethals to explain how a dam could hold in check such an immense body of water. Colonel Goethals, in his usual lucid way, explained that it was because of that well-known principle of physics that the outward pressure of water is determined by its depth and not by its volume — that a column of water 10 feet high and a foot thick would have just as much outward pressure as a lake 200 square miles in extent and 10 feet deep. Still unconvinced, the Senator pressed his examination further. At this juncture Senator Knox, who is a

past master at the art of answering a question with a question, interposed, and asked his colleague: "Senator, if your theory holds good, how is it that the dikes of Holland hold in check the Atlantic Ocean?"

CHAPTER IV

THE LOCKS

SHIPS that pass Panama way will climb up and down a titanic marine stairway, three steps up into Gatun Lake and three steps down again. These steps are the 12 huge locks in which will center the operating features of the Isthmian waterway. The building of these locks represents the greatest use of concrete ever undertaken. The amount used would be sufficient to build of concrete a row of six-room houses, reaching from New York to Norfolk, via Philadelphia, Baltimore, Washington and Richmond — houses enough to provide homes for a population as large as that of Indianapolis.

The total length of the locks and their accessories, including the guide walls, approximates 2 miles. The length of the six locks through which a ship passes on its voyage from one ocean to the other is a little less than 7,000 feet.

If one who has never seen a lock canal is to get a proper idea of what part the locks play in the Panama Canal, he must follow attentively while we make an imaginary journey through the canal on a ship that has just come down from New York. Approaching the Atlantic entrance from the north, we pass the end of the great man-made peninsula, jutting out 11,000 feet into the bay known as

Toro Point Breakwater. It was built to protect the entrance of the canal, the harbor, and anchorages from the violent storms that sweep down from the north over that region. Omitting our stops for the payment of tolls, the securing of supplies, etc., we steam directly in through a great ditch 500 feet wide and 41 feet deep, which simply permits the ocean to come inland 7 miles to Gatun. When we arrive there we find that our chance to go farther is at an end unless we have some means of getting up into the beautiful lake whose surface is 85 feet above us. Here is where the locks come to our rescue. They will not only give us one lift, but three.

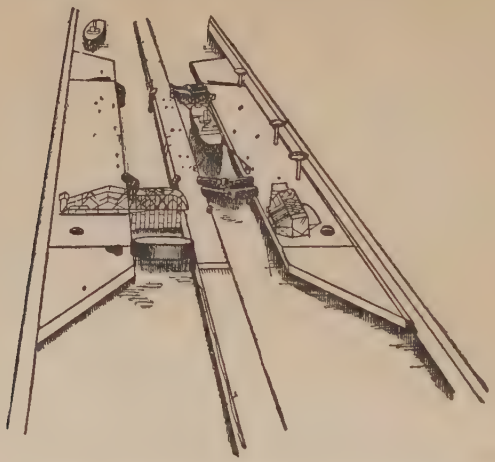
When we approach the locks we find a great central pier jutting out into the sea-level channel. If our navigating officers know their duty they will run up alongside of this guide wall and tie up to it. If they do not they will run the ship's nose into a giant chain, with links made of 3-inch iron, that is guaranteed to bring a 1,000-ton ship, going at the rate of 5 knots per hour, to a dead standstill in 70 feet. When we are once safely alongside the guide wall, four quiet, but powerful locomotives, run by electricity, come out and take charge of our ship. Two of them get before it to pull us forward, and two behind it to hold us back. Then the great chain, which effectively would have barred us from going into the locks under our own steam, or from colliding with the lock gates, is let down and we begin to move into the first lock.

Starting at the sea-level channel, the first, second, and third gates are opened and our ship

towed into the first lock. Then the second and third gates are closed again, and the lock filled with water, by gravity, raising the ship at the rate of about 2 feet a minute, although, if there is a great rush of business, it may be filled at the rate of 3 feet a minute. When the water in this lock reaches the level of the water in the lock above, gates four and five are opened, and we are towed in. Then gate four is closed again, and water is let into this lock until it reaches the level of the third one. Gates six, seven, and eight are next opened, and we are towed into the upper lock. Gates six and seven are now closed, and the water allowed to fill the third lock until we are up to the level of Gatun Lake. Then gates nine and ten are opened, the emergency dam is swung from athwart the channel, if it happens to be in that position, the fender chain like the one encountered when we entered the first lock, and like the ones which protect gates seven and eight, is let down, the towing engines turn us loose, and we resume our journey, with 32 miles of clear sailing, until we reach Pedro Miguel. Here, by a reverse process, we are dropped down $30\frac{1}{3}$ feet. Then we go on to Miraflores, a mile and a half away, where we are lifted down $54\frac{2}{3}$ feet in two more lifts. This brings us back to sea level again, where we meet the waters of the Pacific, and steam out upon it through a channel 500 feet wide and 8 miles long.

Having learned something of the part the locks play in getting us across the Isthmus, by helping us up out of one ocean into Gatun Lake and then dropping down into the other ocean, it will be interesting to note something of the mechanism. A

very good idea of how a lock looks may be gathered from the accompanying bird's-eye view of the model of Pedro Miguel Lock.

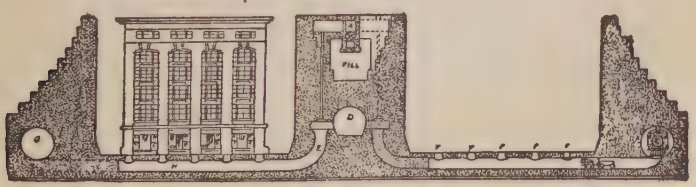


FROM A MODEL OF PEDRO MIGUEL LOCK

It will be seen that there are two of them side by side — twin locks, they are called, making them like a double-track railway. The lock on the right is nearly filled for an upward passage. The ship will be seen in it, held in position by the four towing engines, which appear only as tiny specks hitched to hawsers from the stem and stern. Behind the ship are the downstream gates. They were first opened to admit the ship, and then closed to impound the water that flows up through the bottom of the lock. Ahead are the upstream gates, closed also until the water in the lock is brought up to the level of the water in the lake. Then the gates will be opened, the big

chain fender will be dropped down, and the ship will be towed out into the lake and turned loose. On the side wall of the right lock there is a big bridge set on a pivot so that it can be swung around across the lock and girders let down from it to serve as a foundation upon which to lay a steel dam if anything happens to the locks or gates. On the other lock the bridge has been swung into position, and the steel girders let down. Great steel sheets will be let down on live roller bearings on these girders, and when all are in place they will form a watertight dam of steel. Between this bridge and the reader is a huge floating tank of steel, which may be used to dam all the water out of the locks when that is desired.

Referring to the next figure we see a cross section of the twin locks. The side walls are from 45 to 50 feet thick at the floor. At a point $24\frac{1}{3}$ feet above the floor they begin to narrow by a series of 6-foot steps until they are 8 feet wide at the top. The middle wall is 60 feet wide all the way up, although at a point $42\frac{1}{2}$ feet above the lock floor room is made for a filling of earth and for a three-story tunnel, the top story being used as a passageway for the operators, the second story as a conduit for electric wires, and the lower story as a drainage system.



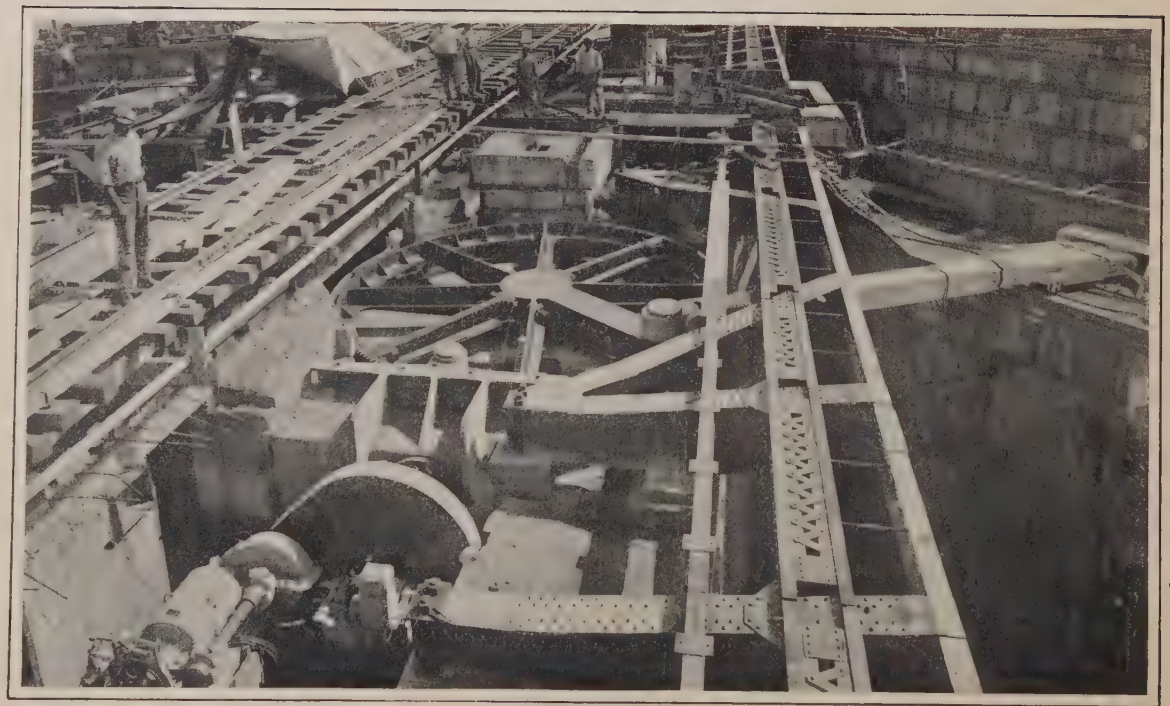
A CROSS-SECTION OF LOCKS, GIVING AN IDEA OF THEIR SIZE

In this figure D and G are the big 18-foot culverts through which water is admitted from the lake to the locks. Each of these three big culverts, which are nearly 7,000 feet long, is large enough to accommodate a modern express train, and is about the size of the Pennsylvania tubes under the Hudson and East Rivers. H represents the culverts extending across the lock from the big ones. Each of them is big enough to accommodate a two-horse wagon, and there are 14 in each lock. Every alternate one leads from the side wall culvert and the others from the center wall culvert. F represents the wells that lead up through the floor into the lock, each larger in diameter than a sugar barrel in girth. There are five wells on each cross culvert, or 70 in the floor of each lock.

The flow of the water into the locks and out again is controlled by great valves. The ones which control the great wall tunnels or culverts are called Stoney Gate valves, and operate something like giant windows in frames. They are mounted on roller bearings to make them work without friction. The others are ordinary cylindrical valves, but, having to close a culvert large enough to permit a two-horse team to be driven through it, they must be of great size. When a ship is passing from Gatun Lake down to the Atlantic Ocean, the water in the upper lock is brought up to the level of that in the lake, being admitted through the big wall culverts, whence it passes out through the 14 cross culverts and up into the locks through the 70 wells in the floor. Then the ship is towed in, the gates are shut behind

CONCRETE MIXERS, GATUN

A CENTER WALL CULVERT, GATUN LOCKS



THE MACHINERY FOR MOVING A LOCK GATE

it, the valves are closed against the water in the lake, the ones permitting the escape of this water into the lock below are opened, and it continues to flow out of the upper lock into the lower one until the water in the two has the same level. Then the gates between the two locks are opened, the ship is towed into the second one and the operation is repeated for the last lock in the same way.

The gates of the locks are an interesting feature. Their total weight is about 58,000 tons. There are 46 of them, each having two leaves. Their weight varies from 300 to 600 tons per leaf, dependent upon the varying height of the different gates. The lowest ones are 47 feet high and the highest ones 82 feet, their height depending upon the place where they are used. Some of these are known as intermediate gates, and are used for short ships, when it is desired to economize on both water and time. They divide each lock chamber into two smaller chambers of 350 and 550 feet, respectively. Perhaps 90 per cent of all the ships that pass Panama will not need to use the full length lock — 1,000 feet. Duplicate gates will always be kept on the ground as a precaution against accident. Each leaf is 65 feet wide and 7 feet thick. The heaviest single piece of steel in each one of them is the lower sill, weighing 18 tons. It requires 6,000,000 rivets to put them together. In the lower part of each gate is a huge tank. When it is desired that the gate shall have buoyancy, as when operating it, this tank will be filled with air. When closed it is filled with water. The gates are opened and closed by a

huge arm, or strut, one end of which is connected to the gate and the other to a huge wheel in the manner of the connecting rod to the driver of a locomotive. Leakage through the space between the gate and the miter sill on the floor of the lock is prevented by a seal which consists of heavy timbers with flaps of rubber 4 inches wide and half an inch thick. A special sealing device brings the edges of the two leaves of a gate together and holds them firmly while the gates are closed.

Remembering that these gates are nothing more than Brobdingnagian double doors which close in the shape of a flattened V, it follows that they must have hinges. And these hinges are worth going miles to see. That part which fastens to the wall of the lock weighs 36,752 pounds in the case of the operating gates, and 38,476 pounds in the protection gates. These latter are placed in pairs with the operating gates at all danger points — so that if one set of gates are rammed down, another pair will still be in position. The part of the hinge attached to the gate was made according to specifications which required that it should stand a strain of 40,000 pounds before stretching at all, and 70,000 pounds before breaking. Put into a huge testing machine, it actually stood a strain of 3,300,000 pounds before breaking — seven times as great as any stress it will ever be called upon to bear. The gates are all painted a lead gray, to match the ships of the American Navy. Those which come into contact with sea water will be treated with a barnacle-proof preparation.

Now that we have described the locks, we may go back and see them in course of construction.

The first task was getting the lock building plant designed and built. At Gatun the plant consisted of a series of immense cableways, an electric railroad, and enormous concrete mixers. Great towers were erected on either side of the area excavated for the locks, with giant cables connecting them. These towers were 85 feet high, and were mounted on tracks like steam shovels, so that they could be moved forward as the work progressed. The cables connecting them were of $2\frac{1}{2}$-inch lock steel wire covered with interlocking strands. They were guaranteed to carry 6 tons at a trip, 20 trips an hour, and to carry 60,000 loads before giving way. They actually did better than the specifications called for as far as endurance was concerned.

The sand for making the concrete for Gatun came from Nombre de Dios (Spanish for Name of God), and the gravel from Porto Bello. The sand and gravel were towed in great barges, first through the old French Canal, and later through the Atlantic entrance of the present canal. Great clamshell buckets on the Lidgerwood cableways would swoop down upon the barges, get 2 cubic yards of material at a mouthful, lift it up to the cable, carry it across to the storage piles and there dump it. In this way more than 2,000,000 wagon loads of sand and gravel were handled.

A special equipment was required to haul the sand, gravel, and cement from the storage piles to the concrete mixers. There were two circular railroads of 24-inch gauge, carrying little electric cars that ran without motormen. Each car was stopped, started, or reversed by a switch attached

to the car. Their speed never varied more than 10 per cent whether they were going empty or loaded, up hill or down. When a car was going down hill its motor was reversed into a generator so that it helped make electricity to pull some other car up the hill. The cars ran into a little tunnel, where each was given its proper load of one part cement, three parts sand, and six parts gravel — 2 cubic yards, in all — and was then hurried on to the big concrete mixers. These were so arranged in a series that it was not necessary to stop them to receive the sand, gravel, and cement, or to dump out the concrete.

On the emptying sides of the concrete mixers there were other little electric railway tracks. Here there were little trains of a motor and two cars each, with a motorman. The train, with two big 2-cubic-yard buckets, drew up alongside two concrete mixers. Without stopping their endless revolutions the mixers tilted and poured out their contents into the two buckets, 2 yards in each. Then the little train hurried away, stopping under a great cable. Across from above the lock walls came two empty buckets, carried on pulleys on the cableway. When they reached a point over the train they descended and were set on the cars, behind the full buckets. The full buckets were then attached to the lifting hooks, and were carried up to the cable and then across to the lock walls, where they were dumped and the concrete spread out by a force of men. Meanwhile the train hustled off with its two empty buckets, ready to be loaded again.

On the Pacific side the concrete handling plant

was somewhat different. Instead of cableways there were great cantilever cranes built of structural steel. Some of these were in the shape of a giant T, while others looked like two T's fastened together. Here the clamshell dippers were run out on the arms of the cranes to the storage piles, where they picked up their loads of material. This was put in hoppers large enough to store material for 10 cubic yards. The sand and stone then passed through measuring hoppers and to the mixers with cement and water added. After it was mixed it was dumped into big buckets on little cars drawn by baby steam locomotives, which looked like overgrown toy engines. These little fellows reminded one of a lot of busy bees as they dashed about here and there with their loads of concrete, choo-chooing as majestically as the great dirt train engines which passed back and forth hard by. The cranes would take their filled buckets and leave empty ones in exchange, and this was kept up day in and day out until the locks were completed. When the plant was removed from Pedro Miguel to Miraflores, a large part of the concrete was handled directly from the mixers to the walls by the cranes without the intermediary locomotive service.

The cost of the construction of the locks was estimated in 1908 at upward of $57,000,000. But economy in the handling of the material and efficiency on the part of the lock builders cut the actual cost far below that figure. On the Atlantic side about a dollar was saved on every yard of concrete laid — about $2,000,000. On the Pacific side more than twice as much was saved.

Before the locks could be built it became necessary to excavate down to bed rock. This required the removal of nearly 5,000,000 cubic yards of material at Gatun. Then extensive tests were made to make certain that the floor of the locks could be anchored safely to the rock. These tests demonstrated that by using the old steel rails that were left on the Isthmus by the French, the concrete and rock could be tied together so firmly as to defy the ravages of water and time. A huge apron of concrete was built out into Gatun Lake from the upper locks at that place, effectively preventing any water from getting between the rocks and the concrete lying upon them.

CHAPTER V

THE LOCK MACHINERY

ONE of the problems that had to be solved before the Panama Canal could be presented to the American people as a finished waterway, was that of equipping it with adequate and dependable machinery for its operation. Panama canals are not built every year, so it was not a matter of ordering equipment from stock; everything had to be invented and designed for the particular requirement it was necessary to meet. And the first and foremost requirement was safety. When we look over the canal machinery we see that word "safety" written in every bolt, in every wheel, in every casting, in every machine. We see it in the devices designed for protection and in those designed for operation as well. We see it in the giant chain that will stop a vessel before it can ram a gate; we see it in the great cantilever pivot bridges that support the emergency dams; we see it in the double lock gates at all exposed points; we see it in the electric towing apparatus, in the limit switches that will automatically stop a machine when the operator is not attending to his business, in the friction clutches that will slip before the breaking point is reached. Safety, safety, safety, the word is written everywhere.

The first thing a ship encounters when it approaches the locks is the giant chain stretched across its path. That chain is made of links of 3 inches in diameter. When in normal position it is stretched across the locks, and the vessel which does not stop as soon as it should will ram its nose into the chain. There is a hydraulic paying-out arrangement at both ends of the chain, and when the pressure against it reaches a hundred gross tons the chain will begin to pay out and gradually bring the offending vessel to a stop. After a ship strikes the chain its momentum will be gradually reduced, its energy being absorbed by the chain mechanism. While the pressure at which the chain will begin to yield is fixed at 100 gross tons, the pressure required to break it is 262 tons. Thus the actual stress it can bear is two and a half times what it will be called upon to meet. The mechanism by which the paying-out of the chain is accomplished is exceedingly ingenious. The principle is practically the reverse of that of a hydraulic jack. The two ends of the 428-foot chain are attached to big plungers in the two walls of the locks. These plungers fit in large cylinders, which contain broad surfaces of water. They are connected with very small openings, which are kept closed until a pressure of 750 pounds to the square inch is exerted against them. By means of a resistance valve these openings are then made available, the water shooting out as through a nozzle under high pressure. This permits the chain plunger to rise gradually, while keeping the tension at 750 pounds to the inch, and the paying-out of the chain proceeds accord-

ingly. Of course not all ships will strike the chain at the same speed, and in some cases the paying-out process will have to be more rapid than in others. This is provided for by the automatic enlargement of the hole through which the water is discharged, the size of the hole again becoming smaller as the tension of the chain decreases. This chain fender will stop the *Olympic* with full load, when going a mile and a half an hour, bringing it to a dead standstill within 70 feet, or it will stop an ordinary 10,000-ton ship in the same distance even if it have a speed of 5 miles. The function of the resistance valve is to prevent the chain from beginning to pay out until the stress against it goes up to 100 tons, and to regulate the paying-out so as to keep it constant at that point, so long as there is necessity for paying-out. Any pressure of less than a hundred tons will not put the paying-out mechanism into operation.

When a ship is to be put through the locks the chain will be let down into great grooves in the floor of the lock. There is a fixed plunger operating within a cylinder, which, in turn, operates within another cylinder, the resulting movement, by a system of pulleys, being made to pay out or pull in 4 feet of chain for every foot the plunger travels. The chain must be raised or lowered in one minute, and always will have to be lowered to permit the passage of a ship. The fender machines are situated in pits in the lock walls. These pits are likely to get filled with water from drippings, leakages, wave action, and drainage, so they are protected with automatic pumps. Float valves are lifted when the water rises in the

pits. This automatically moves the switch controlling an electric motor, which starts a pump to working whenever the water gets within 1 inch of the top of the sump beneath the floor of the pit. Twenty-four of these chain fenders are required for the protection of the locks, and each requires two such tension machines.

No ship will be allowed to go through the canal except under the control of a canal pilot. He will certainly bring it to a stop at the approach wall. But if he does not, there is the chain fender. There is not a chance in a thousand for a collision with it, and not a chance in a hundred thousand that the ship will not be stopped when there is such a collision.

But if the pilot should fail to stop the ship, and it should collide with the fender chain, and then if the fender chain should fail to stop it, there would be the double gates at the head of the lock. There is not one chance in a hundred that a ship, checked as it inevitably would be by the fender chain, could ram down the first, or safety gate. But if it did, there would still be another set of gates some 70 feet away. The chances here might be one in a hundred of the second set being rammed down. From all this it will be seen that the chances of the second pair of gates being rammed is so remote as to be almost without the realm of possibility. But suppose all these precautions should fail, and suddenly the way should be opened for the water of Gatun Lake to rush through the locks at the destructive speed of 20 miles an hour? Even that day has been provided against by the construction of the big emergency dams. The

emergency dams, like the fender chains, are designed only for protection, and have no other use in the operation of the locks. There will be six of these dams, one across each of the head locks at Gatun, Pedro Miguel, and Miraflores.

These emergency dams will be mounted on pivots on the side walls of the locks about 200 feet above the upper gates. When not in use they will rest on the side wall and parallel with it. When in use they will be swung across the locks, by electric machinery or by hand, and there rigidly wedged in. It will require two minutes to get them in position by electricity and 30 minutes by hand. There is a motor for driving the wedges which will hold the dam securely in position, and limit switches to prevent the dams being moved too far.

When a bridge is put into position across the lock, a series of wicket girders which are attached to the upstream side of the floor of the bridge are let down into the water, the connection between the bridge and one end of each girder being made by an elbow joint. The other end goes down into the water, its motion being controlled by a cable attached some distance from the free end of the girder and paid out or drawn in over an electrically operated drum. This free end passes down until it engages a big iron casting embedded in the concrete of the lock floor. This makes a sort of inclined railway at an angle of about 30 degrees from the perpendicular, over which huge steel plates are let down into the water. There are six of these girders, and they are all made of the finest nickel steel. When they are all in position, a row of six plates are let down, and they make the

stream going through the locks several feet shallower. Then another row of plates is let down on these, and the stream becomes that much shallower. Another row of plates is added, and then another, until there is a solid sheet of steel plates resting on the six girders, and they make a complete steel dam which effectively arrests the mad impulse of the water in Gatun Lake to rush down into the sea. The plates are moved up and down by electrical machinery, and are mounted on roller-bearing wheels, so that the tremendous friction caused by their being pressed against the girders by the great force of the water may be overcome. That the emergency dams will be effective is shown by the experience at the "Soo" locks, on the canal connecting Lakes Superior and Huron. There, a vessel operating under its own power, rammed a lock gate. Although the emergency dam had grown so rusty by disuse that it could be operated only by hand, it was swung across the lock and effectively fulfilled its mission of checking the maddened flow of the water.

Another protective device for the locks is the big caisson gates that will be floated across the head and tail bays when it is desired to remove all the water from the locks for the purpose of permitting the lower guard gates to be examined, cleaned, painted, or repaired, and for allowing the sills of the emergency dams to be examined in the dry. The caisson gates are 112½ feet long, 36 feet beam, and have a light draft of 32 feet and a heavy draft of 61 feet. When one is floated into position to close the lock, water will be admitted to make it sink to the proper depth. Then its

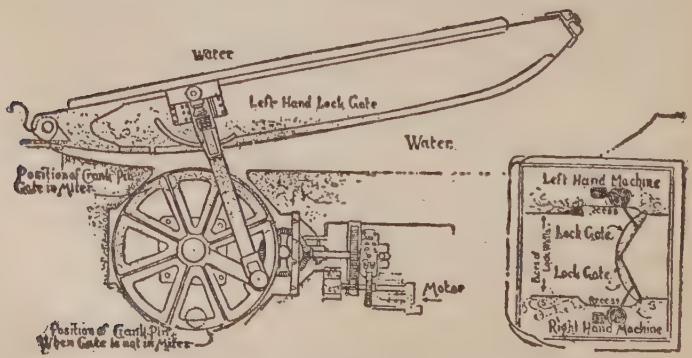
large centrifugal pumps, driven by electric motors, will pump the water out of the lock. When the work on the lock is completed these pumps will pump the water out of the caisson itself until it becomes buoyant enough to resume its light draft, after which it will be floated away.

The machinery for opening and closing the lock gates called for unusual care in its designing. The existing types of gate-operating machinery were all studied, and it was found that none of them could be depended on to prove satisfactory, so special machines had to be designed.

A great wheel, resembling a drive wheel of a locomotive, except that a little over half of the rim is cog-geared, is mounted in a horizontal position on a big plate, planted firmly in the concrete of the wall and bolted there with huge bolts 11 feet long and $2\frac{1}{4}$ inches in diameter. This plate weighs over 13,000 pounds, and the wheel, cast in two pieces, weighs 34,000 pounds. As the weight of the rim of the wheel on the eight spokes probably would tax their strength too much when the wheel is under stress, this is obviated by four bearing wheels, perpendicular to the big wheel, which support the rim. Between the crank pin and the point of attachment on the gate leaf there is a long arm, or strut, designed to bear an operating strain of nearly a hundred tons. The wheel will be revolved by a motor geared to the cogged part of the rim.

An ingenious arrangement of electric switches is that used to protect the gate-moving machines from harm. The big connecting rod between the master wheel and the gate leaf is attached to the

gate leaf by a nest of springs capable of sustaining a pressure of 184,000 pounds, in addition to the fixed pressure of 60,000 pounds. Should any obstruction interfere with the closing of the gate and threaten a dangerous pressure on the connecting rod, the springs, as soon as they reach their full compression, establish an electrical contact and thus stop the motor. Likewise, should any obstruction come against the gate as the connecting rod is pulling it open, the springs again permit the establishment of an electrical contact and stop the motor. All of these precautions are entirely independent of and supplemental to the limit switches, which cut off the power from the gate-moving machine should the strain reach the danger line. These big machines move the huge gate leaves without the slightest noise or vibration. Such a machine is required for each of the 92 leaves used in the 46 gates with which the locks are equipped. The operator can open or close one of these big gates in two minutes.



ONE OF THE 92 GATE-LEAF MASTER WHEELS

The control of the water in the culverts of the locks is taken care of by an ingeniously designed series of valves. The big wall culverts, 18 feet in diameter, are divided into two sections at the points where the valves are installed, by the construction of a perpendicular pier. This makes two openings 8 by 18 feet. The big gates of steel are placed in frames to close these openings just as a window sash is placed in its frame. They are mounted on roller bearings, so as to overcome the friction caused by the pressure of water against the valve gates. They must be mounted so that there is not more than a fourth of an inch play in any direction. The big wall culvert gates will weigh about 10 tons each, and must be capable of operating under a head of more than 60 feet of water. They will be raised and lowered by electricity.

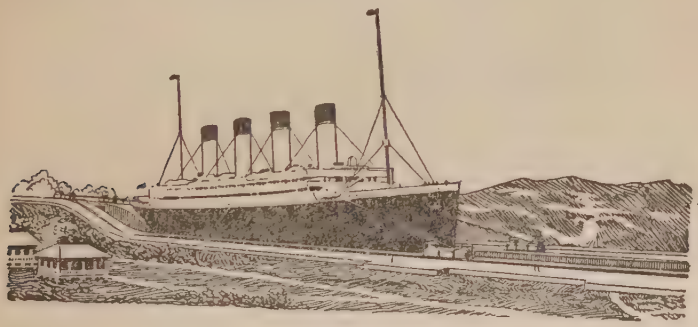
The electric locomotives which will be used to tow ships through the locks are one of the interesting features of the equipment. There will be 40 of them on the 3 sets of locks. The average ship will require four of them, two at the bow and two at the stern, to draw it through the locks. They will run on tracks on the lock walls, and will have two sets of wheels. One set will be cogged, and will be used when the locomotives are engaged in towing. The other set will be pressed into service when they are running light. When a vessel is in one lock waiting for the water to be equalized with that in the next one and the gates opened to permit passage, the forward locomotives will run free up the incline to the lock wall above, paying out hawser as they go. When they get

to the next higher level they are ready to exert their maximum pull. Each locomotive consists of three parts: two motors hitched together, and the tandem may be operated from either end. The third part is a big winding drum around which the great hawsers are wound. This towing windlass permits the line to be paid out or pulled in and the distance between the ship and the locomotives varied at will. The locomotive may thus exert its pull or relax it while standing still on the track, a provision especially valuable in bringing ships to rest. In the main, however, the pull of the locomotive is exercised by its running on the semi-suppressed rack track anchored in the coping of the lock walls. Each flight of locks will be provided with two towing tracks, one on the side and one on the center wall. Each wall will be equipped with a return track of ordinary rails, so that when a set of locomotives has finished towing a ship through the locks they can be switched over from these tracks and hustled back for another job. When they reach the inclines from one lock to the next above the rack track will be pressed into service again until they reach the next level stretch.

Here again one meets the familiar safeguard against accident. Some engineer of one of these towing locomotives might sometime overload it, so the power of doing so has been taken out of his hands. On the windlass or drum that holds the towing hawser there is a friction coupling. If the engineer should attempt to overload his engine, or if for any other reason there should suddenly come upon the locomotive a greater strain than it could bear, or upon the track, or upon the hawser,

the friction clutch would let loose at its appointed tension of 25,000 pounds, and all danger would be averted.

When the locomotives are towing a ship from the walls it is natural that there should be a side pull on the hawser. This is overcome by wheels that run against the side of the track and are mounted horizontally. All of the towing tracks extend out on the approach walls of the locks so that the locomotives can get out far enough to take charge of a ship before it gets close enough to do the locks any damage.



A *Mauretania* IN THE LOCKS

From the foregoing it will be seen that a great deal of electric current will be required in the operation of the locks. This will be generated at a big station at Gatun, with a smaller one at Miraflores, and they will be connected. The overflow water will be used for generating the required current, and in addition to the operation of the lock machinery it will operate the spillway gates, furnish the necessary lighting current, and

eventually it may furnish the power for an electrified Panama Railroad.

In passing a ship through the canal it will be necessary to open and close 23 lock gates, of an aggregate weight of more than 25,000 tons, to lower and raise 12 fender chains, each weighing 24,000 pounds, and to shut and open dozens of great valves, each of which weighs tons. All these operations at each set of locks will be controlled by one man, at a central switchboard. In addition to these operations there is the towing apparatus. The arrangement at Gatun is typical; there 4 fender chains must be operated, 6 pairs of miter gates, and 46 valves. In all not less than 98 motors will be set in motion twice, and sometimes this number may be increased to 143. Some of them are more than half a mile away from the operator, and half of them are nearly a quarter of a mile away.

The operator in his control house will be high enough to have an uninterrupted view of the whole flight of locks over which he has command. His control board will consist of a representation of the locks his switches control. On his model he will see the rise and fall of the fender chains as he operates them, the movement of the big lock gates as they swing open or shut, the opening and closing of the valves which regulate the water in the culverts, and the rise and fall of the water in the locks.

A system of interlocked levers will prevent him from doing the wrong thing in handling his switches. Before he can open the valves at one end of a lock he must close those at the other end.

Before he can open the lock gates, the valves in the culverts must be set so that no harm can result. Before he can start to open a lock gate, he must first have released the miter-forcing machine that latches the gates. Before he can close the gates protected by a fender chain, he must first have thrown the switch to bring the fender chain back to its protecting position, and he can not throw the switch to lower the chain until he first has provided for the opening of the gate it protects. All of this interlocking system makes it next to impossible to err, and taking into consideration the additional safeguard of limit switches, which automatically cut off the power when anything goes wrong, it will be seen that the personal equation is all but removed from the situation.

CHAPTER VI

CULEBRA CUT

CULEBRA CUT! Here the barrier of the continental divide resisted to the utmost the attacks of the canal army; here disturbed and outraged Nature conspired with gross mountain mass to make the defense stronger and stronger; here was the mountain that must be moved. Here came the French, jauntily confident, to dig a narrow channel that would let their ships go through. The mountain was the victor. And then here came the Americans, confident but not jaunty. They weighed that mass, laid out the lines of a wider ditch, arranged complicated transportation systems to take away the half hundred million cubic yards of earth and rocks that they had measured. Nature came to the aid of the beleaguered mountain. The volcanic rocks were piled helter-skelter and when the ditch deepened the softer strata underneath refused to bear the burden and the slides, slowly and like glaciers, crept out into the ditch, burying shovels and sweeping aside the railway tracks. Even the bottom of the canal bulged up under the added stress of the heavier strata above.

Grim, now, but still confident, the attackers fought on. The mountain was defeated.

Now stretches a man-made canyon across the

backbone of the continent; now lies a channel for ships through the barrier; now is found what Columbus sought in vain — the gate through the west to the east. Men call it Culebra Cut.

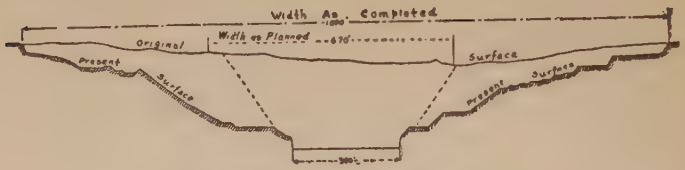
Nine miles long, its average depth is 120 feet. At places its sides tower nearly 500 feet above its channel bottom, which is nowhere narrower than 300 feet.

It is the greatest single trophy of the triumph of man over the terrestrial arrangement of his world. Compared to it, the scooping out of the sand levels of Suez seems but child's play — the tunnels of Hoosac and Simplon but the sport of boys. It is majestic. It is awful. It is the Canal.

When estimates for digging the canal were made, it was calculated that 53,000,000 cubic yards of material would have to be removed from the cut, and that under the most favorable conditions it would require eight and a half years to complete the work. But at that time no one had the remotest idea of the actual difficulties that would beset the canal builders; no one dreamed of the avalanches of material that would slide into the cut.

One can in no way get a better idea of the meaning of the slides and breaks in Culebra Cut than to refer to the accompanying figure. There it will be seen that whereas it was originally planned that the top width of the cut at one point should be 670 feet, it has grown wider, because of slides and breaks, to as much as 1,800 feet at one place. In all, some 25,000,000 cubic yards of material which should have remained outside the canal

prism slipped into it and had to be removed by the steam shovels.



THE EFFECT OF SLIDES

No less than 26 slides and breaks were encountered in the construction of Culebra Cut, their total area being 225 acres. The largest covered 75, and another 47 acres. When the slides, which were more like earthen glaciers than avalanches, began to flow into the big ditch, sometimes steam shovels were buried, sometimes railroad tracks were caught beneath the débris, and sometimes even the bottom of the cut itself began to bulge and disarrange the entire transportation system, at the same time interfering with the compressed air and water supplies. But with all these trials and tribulations, the army that was trying to conquer the eternal hills that had refused passage to the ships of the world for so many centuries, kept up its courage and renewed its attack. The result is that ships sail through Culebra and that engineers everywhere have new records of efficiency to inspire them.

These efficiency records are told in the cost-keeping reports based upon one of the most careful and thorough cost-accounting systems ever devised. This system was instituted for the purpose of keeping a check upon all expenditures

by reducing everything to a unit basis and then comparing the cost of doing the same thing at different places. For instance, if it were found that it cost more to excavate a cubic yard of material at one place than at another, under identical conditions, this fact was brought to the attention of the men responsible and an intimation given that there seemed to be room for taking up a little lost motion. The lost motion usually was recovered or else someone had to be satisfied that conditions were not identical after all.

In no other part of the canal work do these cost-keeping reports tell such a graphic story as in Culebra Cut. In spite of the fact that as the cut became deeper it became narrower, and the slides and breaks became more troublesome, to say nothing of the extra effort required to get the excavated material out of the cut, every unit cost was forced down notch by notch and year by year until the bottom in costs was reached only a little before the actual bottom of the cut was exposed to view.

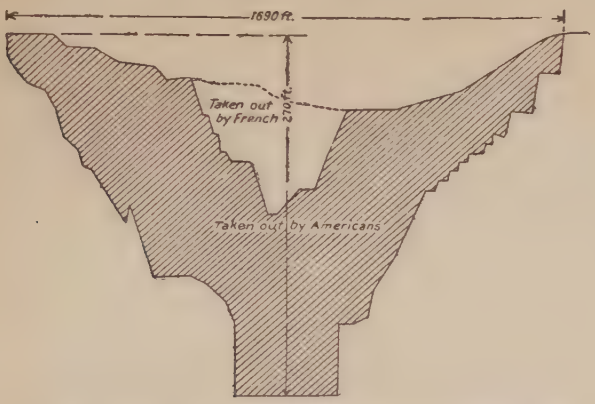
For instance, in 1908 it cost $11\frac{1}{2}$ cents a yard to load material with steam shovels, while in 1912 it cost less than 7 cents. In 1908 it cost more than 14 cents a yard for drilling and blasting; in 1912 it cost less than 12 cents. In 1908 it cost $18.54 to haul away a hundred yards of spoil; in 1912 it required only $13.31 to perform the same operation, although the average distance it had to be hauled had increased 50 per cent. In 1908 it cost more than 13 cents a yard to dump the material as compared with less than 5 cents in 1912. The whole operation of excavating and removing

the material, including overhead charges and depreciation, fell from $1.03 a cubic yard in 1908 to less than 55 cents a yard in 1912. And that is why 232,000,000 cubic yards of material were removed for less than it was estimated 135,000,000 cubic yards would cost.

To remove the 105,000,000 cubic yards of earth from the backbone of the Americas required about 6,000,000 pounds of high-grade dynamite each year to break up the material, so that it might be successfully attacked by the steam shovels. To prepare the holes for placing the explosives required the services of 150 well drills, 230 tripod rock drills, and a large corps of hand drillers. Altogether they drilled nearly a thousand miles of holes annually. During every working day in the year about 600 holes were fired. They had an average depth of about 19 feet. In addition to this a hundred toe holes were fired each day, and as many more "dobe" blasts placed on top of large boulders to break them up into loadable sizes. So carefully was the dynamite handled that during a period of three years, in which time some 19,000,000 pounds were exploded in Culebra Cut, only eight men were killed.

The transportation of the spoil from Culebra Cut was a tremendous job. A large percentage of it was hauled out in Lidgerwood flat cars. Twenty-one cars made up the average Lidgerwood train. It required about 140 locomotives to take care of the spoil, and the average day saw nearly 3,700 cars loaded and hauled out of the cut. In a single year 1,116,286 carloads of material were hauled out. There were 75 trains in constant

operation, one for each $2\frac{1}{2}$ miles of track in the Central Division, which was approximately 32 miles long. A huge steam shovel, taking up 5



AVERAGE SHAPE AND DIMENSIONS OF CULEBRA CUT

yards of material at a mouthful, would load one of these trains in less than an hour with some 400 yards of material. Then the powerful locomotive attached to it, assisted by a helper engine, would pull the train out of the cut, and then, unassisted, would haul it to the dumping ground some 12 miles or more away.

Arriving near the scene of the dump, another engine, having in front of it a huge horizontal steam windlass mounted on a flat car, was hooked on the rear end of the train. Then the locomotive which had brought the train to the dump was uncoupled and moved away, and in its stead there was attached an empty flat car, on which there was a huge plow. A long wire cable was stretched from the big windlass at the other end of the train

and attached to this plow. As the drum of the windlass began to turn it gradually drew the plow forward over the 21 cars, plowing the material off as it went forward. The cars were equipped with a high sideboard on one side and had none at all on the other. A flat surface over which the plow could pass from car to car was made by hinging a heavy piece of sheet steel to the front end of each car and allowing it to cover the break between that car and the next, thus affording a practically continuous car floor over 800 feet long. The operation of unloading 400 yards of material with this plow seldom required more than 10 minutes.

After the plow had finished its work it left a long string of spoil on one side of the track which must be cleared away. So another plow, pushed by an engine, attacked the spoil and forced it down the embankment. This process of unloading and spreading the material was kept up until the embankment became wide enough to permit the track to be shifted over. Here another especially designed machine, the track shifter, was brought into play. It was a sort of derrick mounted on a flat car, and with it the track shifters were able to pick up a piece of track and lift it over to the desired position. With this machine a score of men could do the work that without it would have required a gang of 600 men.

In addition to the Lidgerwood dirt trains there were a large number of trains made up of steel dump cars which were dumped by compressed air, and still other trains made up of small hand-dumped cars, and each class found its own peculiar uses.

As has been said, the problem of digging the big ditch has been one of the transportation of the spoil, and this has involved numerous difficulties. In Culebra Cut no little difficulty was experienced in keeping open enough tracks to afford the necessary room for dirt trains. Slides came down and forced track after track out of alignment, burying some of them beyond the hope of usable recovery; often the very bottom of the cut itself heaved up under the stress of the heavy weight of faulty strata on the sides of the mountain; and sometimes the slides and breaks threatened entirely to shut up one end of the cut.

In hauling away the spoil one improvement after another was made in the interest of efficiency. It was found at first that the capacity of a big Lidgerwood flat car was only about 16 cubic yards, and that with a sideboard on only one side of the car, the load did not center well on the car, thus placing an undue strain on the wheels on one side. The transportation department, therefore, extended the bed of the car further out over the wheels on the open side, and this served a triple purpose — it permitted the steam shovels to load the cars so that the load rested in the center, increased the capacity of each car by about 3 yards, and permitted the unloader plow to throw the spoil further from the track, thus adding to the efficiency of the dumping apparatus.

Frequent breaks in the trains were caused by worn couplers. These accidents were almost entirely overcome by equipping each train with a sort of "bridle" which prevented the separation of the cars in the event of the parting of a defective

coupler. In the operation of the unloader plows it was found that the big cables frequently broke when a plow would strike an obstruction on the car, and this caused no end of annoyance and frequent delays. Then someone thought of putting between the cable and the plow a link whose breaking point was lower than that of the cable. After that when a plow struck an obstruction the cable did not part — the link simply gave way, and another was always at hand. On the big spreaders no less than 51 improvements were made, each the answer of the engineers to some challenge from the stubborn material with which they had to contend.

The major portion of the material excavated from the canal had to be hauled out and dumped where it was of no further use. From the Central Division alone, which includes Culebra Cut, upward of a hundred million cubic yards of material was hauled away and dumped as useless. At Tabernilla one dump contained nearly 17,000,000 cubic yards. A great deal of spoil, however, was used to excellent advantage. Wherever there was swampy ground contiguous to the permanent settlements it was covered over with material from the cut and brought up above the water level. Many hundreds of acres were thus converted from malaria-breeding grounds into high and dry lands.

During the last stages of the work in Culebra Cut it was found that some of the slides were so bad that they were breaking back of the crest of the hills that border the cut. Therefore it was found to be feasible to attack the problem by

sluicing the material down the side of the hills into the valley beyond. To this end a big hydraulic plant which had been used on the Pacific end of the canal was brought up and installed beyond the east bank of the cut. A reservoir of water was impounded and tremendous pumps installed. They pumped a stream of water 40 inches in diameter. This was gradually tapered down to a number of 4-inch nozzles, and out of these spouted streams of water with a pressure of 80 pounds to the square inch. These streams ate away the dirt at a rapid rate.

The slides did not hold up the completion of the canal a minute, at least to the point of usability. The day that the lock gates were ready there was water enough in the canal to carry the entire American navy from ocean to ocean. That day the big dredges from the Atlantic and the Pacific were brought into the cut, and with them putting the finishing touches on the slides at the bottom, and the hydraulic excavators attacking them at the top, the problem of the slides was solved.

Viewing Culebra Cut in retrospect, it proved an immensely less difficult task than some prophesied, and a much more serious one than others predicted. There were those who opposed the building of the Panama Canal because of the belief that Culebra Cut could not be dug, that Culebra Mountain was an effective barrier to human ambition. Also, there were those who asserted that Gold Hill and Contractor's Hill were in danger of sliding into the big ditch and that they were mountains which neither the faith nor the pocketbooks of the Americans could remove. Others

saw the handwriting of Failure on the wall in the heaving up of the bottom of the cut, interpreting this as a movement from the very depths of the earth. Still others saw it in the smoke that issued from fissures in the cut, which spoke to them of volcanoes being unearthed and told them that the Babel of American ambitions must totter to the ground. They did not know that these were only little splotches of decomposing metals suddenly exposed to the air, any more than their fellow pessimists knew that the heaving up of the bottom of the cut was due to the pressure of the earth on the adjacent banks.

To-day Culebra Mountain bows its lofty head to the genius of the American engineer and to the courage of the canal army. Through its vitals there runs a great artificial canyon nearly 9 miles long, 300 feet wide at its bottom, in places as much as a half mile wide at its top and nearly 500 feet deep at the deepest point. Out of it there was taken 105,000,000 cubic yards of material, and at places it cost as much as $15,000,000 a mile to make the excavations. Through it now extends a great ribbon of water broad enough to permit the largest vessels afloat to pass one another under their own power, and deep enough to carry a ship with a draft beyond anything in the minds of naval constructors to-day. With towering hills lining it on either side, with banks that are precipitous here and farflung there, with great and deep recesses at one place and another telling of the gigantic breaks and slides with which the men who built it had to contend, going through Culebra Cut gives to the human heart a thrill

such as the sight of no other work of the human hand can give. Its magnitude, its awe-inspiring aspect as one navigates the channel between the two great hills which stand like sentinels above it, and the memory of the thousands of tons of dynamite, the hundreds of millions of money and the vast investment of brain and brawn required in its digging, all conspire to make the wonder greater. It is the mightiest deed the hand of man has done.

CHAPTER VII

ENDS OF THE CANAL

WHILE the completed Panama Canal does not wed the two oceans, or permit their waters to mingle in Gatun Lake, it does bring them a little closer together. On the Atlantic side a sea-level channel has been dug from deep water due south to Gatun, a distance of 7 miles. On the Pacific side a similar channel has been dug from deep water in a northwesterly direction to Miraflores, a distance of 8 miles. It follows that 15 of the 50 miles of the canal will be filled with salt water. The remaining 35 miles will be filled with fresh water supplied by the Chagres and the lesser rivers of Panama. The task of digging these sea-level sections was a considerable one and almost every method of ditch digging that human ingenuity has been able to devise was employed. Steam shovels, dipper dredges, ladder dredges, stationary suction dredges, and sea-going suction dredges, all contributed their share toward bringing the waters of the Atlantic to Gatun and those of the Pacific to Miraflores. In addition to these methods, on the Pacific side use was made of the hydraulic process of excavating soft material, washing it loose with powerful streams of water and pumping it out with giant pumps.

THE DISASTROUS EFFECTS OF SLIDES IN CULEBRA CUT

U. S. LADDER DREDGE "COROZAL" AND ONE OF HER MUD BUCKETS

W. G. COMBER

As one travels along the Pacific end of the canal he is reminded of the words of Isaiah:

> "Every valley shall be exalted, and every mountain and hill shall be made low; and the uneven shall be made level, and the rough places a plain."

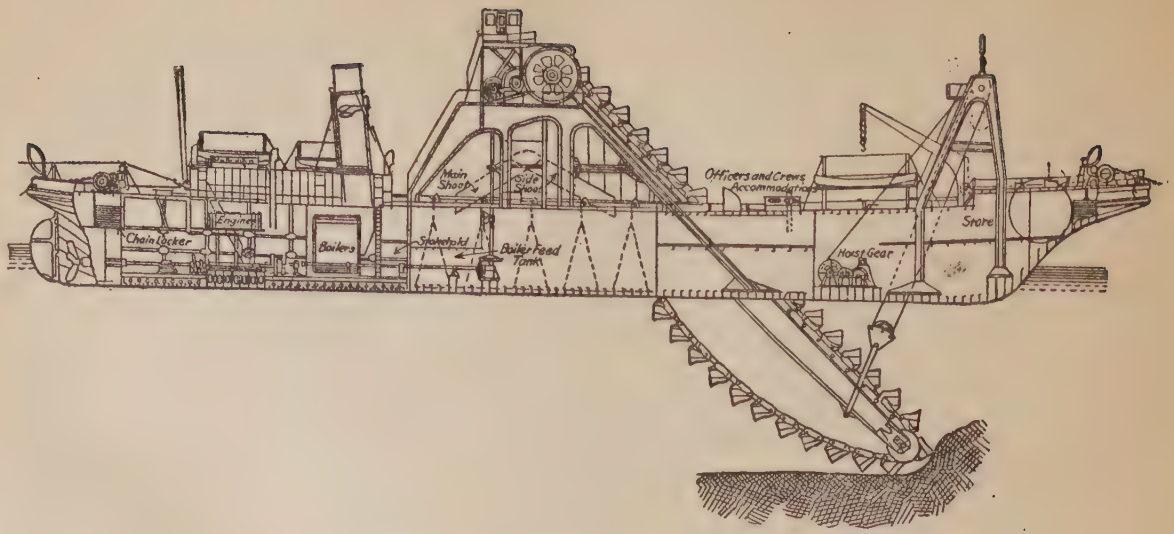
Hundreds of acres of low, marshy land have been filled up, either with mud from the suction dredges and the hydraulic excavators, or with spoil from Culebra Cut. Much of this made land will be valuable for tropical agriculture, while other parts will never serve any purpose other than to keep down the marshes. But they afforded a dumping ground for material taken out of the canal prism, and added something to the improvement of health and living conditions on the Isthmus.

Probably the most interesting process of excavation in the sea-level channels was that of the sea-going suction dredges. These dredges took out material more cheaply than any other kind of excavating machinery used on the Isthmus. Two of them were put to work in 1908, about the time the operations reached full-blast and have been kept in commission ever since. While it cost as much as $70,000 a year to keep each one in commission, they were able to maintain an annual average of about 5,000,000 cubic yards of material excavated at a cost per yard of 5 cents and even less. With steam shovels it ranged from 10 to 20 times as much per yard. These big dredges were built with great bins in their holds and equipped

with powerful 20-inch centrifugal pumps. When at work they steamed up and down the channel, sucking up the mud, and carrying it out to sea.

Another interesting dredge used was the big ladder dredge Corozal. It is a great floating dock, as it were, with a huge endless chain carrying 52 immense, 35-cubic-foot buckets. On the center line amidships there is a large opening down to the water. The big elevator framework carrying the endless chain goes down through this and into the water at a considerable angle. The buckets pass around this, and as they round the end of it their great steel lips dig down into the material until filled, then they come up at the rate of three every five seconds and deposit their burden in a huge hopper which conveys it to the barge at the side of the dredge. The dredge is anchored fast at a given place, and keeps on attacking the material beneath it until the desired level is reached. This dredge, with the sea-going suction dredges, will be retained as the permanent dredging fleet. The stationary suction dredges at the two ends of the canal were used to pump up the soft material and to force it out through long pipe lines into the swamps or into the hydraulic cores of the earth dams.

Several old French ladder dredges were rescued from the jungle and put into commission at the beginning of the work, and they held out faithfully to the end, dividing honors with the newer equipment in hastening the day when the oceans might go inland to Gatun and Miraflores. While they looked like toys beside such giant excavators as the Corozal, they probably showed more



THE *Corozal* AND ITS METHOD OF ATTACK

efficiency than any other class of excavators of their period of construction. They were attended by large self-propelling scows built by the French. When these were filled they steamed out to sea and dumped their burden and then steamed back again for another load. Some of the dredges were attended by ordinary barges which were towed out to sea by tugs and dumped.

Another interesting machine used on the Pacific end of the canal was the Lobnitz rock breaker. This consists of a sort of pile driver mounted on a large barge. Instead of a pile driving weight there is a big battering ram made of round steel, pointed at one end. It is lifted up perhaps 10 feet and allowed to drop suddenly. As some of these rams weigh as much as 25 tons their striking force may be imagined. When the ram struck the rock the top would shake back and forth like a bamboo pole, in spite of the fact that it was made of the best steel and more than 15 inches in diameter. Sooner or later the rams would break off at the water line, this being due to the fact that the constant flexion at that point set the molecules in the steel and took away all its elasticity.

It was found desirable to excavate a part of the sea-level channel before the water was let into it. To accomplish this a big dam, or dike, was built across the channel several miles inland, and steam shovels were used behind this dike. As the work neared completion, however, it was found advisable to let the water come further inland, so that the dredges could extend the field of their activities. To do this another dike was thrown across the channel about a mile north of the first one,

and water was admitted to the section of the big ditch between these two dikes. The engineers were afraid to cut a small ditch in the top of the first dike, and allow the water to eat the dam away as it flowed in, for fear that it would rush in so rapidly it would destroy the second dike. Therefore they filled the basin between the two dikes by siphon and by pumping, a process which required the drawing in of billions of gallons of water. This was accomplished in due time, however, and then 16 tons of dynamite was placed in the no longer useful dike. An electric spark did the rest.

The distinguishing features of the ends of the canal are the big breakwaters at Toro Point, at the Atlantic end, and Naos Island, at the Pacific end. The former extends from the shore out into the sea for a distance of 2 miles and has a large lighthouse at the seaward end. It was built by dumping stone from the shore out into the sea, this process being followed by driving piles into the dumped stone and building a railroad on the crest, over which the stone was hauled for its further extension. The top of the breakwater is covered with huge stones weighing from 8 to 20 tons each, these to make sure that it will stand against the pounding of the waves. Two minor breakwaters were also built at the Atlantic end to protect the terminal basin.

The big dike at Naos Island in the Pacific is more than 17,000 feet long and transforms the island into the cape of a small peninsula. There was a threefold purpose in its construction — to cut out the cross currents that brought thousands

of yards of sand and silt into the canal channel, to afford a dumping place for a large quantity of the spoil from Culebra Cut, and to make a connection with the mainland for the fortifications on Naos, Flamenco, and Perico Islands. In building it the engineers were under the necessity of first building a trestle on which the spoil trains could be backed and dumped. The piles had to be driven in soft, blue mud, and as the rock was dumped, it sank down and down until, at places, ten times as much stone was required as would have been necessary if the ocean bottom had been firm. In addition to this thousands of trainloads of material were dumped in the landward end of the dike, some 20,000,000 cubic yards of material being thus disposed of.

The last part of the canal work to be completed will be the terminal facilities at the ends of the big waterway. At the time this book went to press they were something more than a year from completion, but the indications were that they would be finished within the time limit originally set for the completion of the canal itself. These terminal facilities consist of dry docks, wharfage space, storehouses, and everything else necessary to perform any service that might ordinarily be required for passing ships, whether they be those of commerce or of war. The main coaling station is to be established at the Atlantic end. The storehouses, the laundry, the bakery, and the other equipment of the Isthmian Canal Commission and the Panama Railroad also will be made a part of the permanent terminal plant on that side of the Isthmus.

A large dry dock is being built at the Pacific end having the same usable dimensions as the canal locks, capable of accommodating any vessel that can pass through the canal. The principal machine shops will also be erected there, and a coaling plant of half the capacity of the one at the Atlantic end will be provided. A little to the east of the Pacific terminal works will be stationed the capital of the Canal Zone, where the administrative offices, the governor's residence, and two new towns will be built. The administration building, which is to be a three-story structure of concrete, hollow tile, and structural steel, is to occupy an eminence on the side of Ancon Hill, which will afford a splendid view of the Pacific fortifications, the entrance to the canal channel, a part of the port works, and of the canal itself from the great continental divide to the Pacific.

There one may sit and see ships coming into the canal, tying up at the docks, sailing up the big ditch, and passing through the locks at Miraflores and Pedro Miguel. Near by will be the permanent home of the marines who will be stationed on the Isthmus, their barracks and grounds occupying the broad plateau on the side of Ancon Hill made by taking out the millions of cubic yards of stone required for the concrete works on the Pacific side of the Isthmus. Two permanent towns will be built at Balboa, one for the Americans and the other for the common laborers. The American town will be built under the capitol hill on a broad plain that was made by pumping hydraulic material into a swamp and by dumping spoil from Culebra Cut.

When the terminal plant at Balboa is completed it will represent probably the most extensive and adequate port works in the New World. In addition to the main dry dock it will have a second one which will be smaller, but which will be large enough to accommodate a majority of the ships that will pass through the canal. The existing dry dock at the Atlantic end will be continued in service.

It is certain that none of these port works will ever fail by reason of insecure foundations. Wherever unusual loads were to be carried great piers of reinforced concrete were sent down to solid rock, often a distance of 60 feet below the surface. They consisted of a hollow shell of reinforced concrete which was allowed to sink to hardpan of its own accord or under heavy weight. These shells were built in sections 6 feet high. The bottom section was 10 feet in diameter, and the lower end was equipped with a sharp steel shoe. As the section cut down into the earth of its own weight and that above it, laborers on the inside removed the material under the shoe and as they did so it sank further down. The sections above were only 8 feet in diameter, and did not quite fill up the hole made by the bottom of the section, thus overcoming all skin friction, and permitting the full weight of the series of sections to fall on the lower one. A jet of water was forced around the sinking pier all the time it was going down, and this made its progress the more easy. At times the weight of the superimposed sections was sufficient to force the pier down through the soft mud, while at other times the material became so

heavy that even a 25-ton weight on top of the pier scarcely moved it. At one place a stratum of material was struck about 25 feet below the surface which yielded sulphuretted hydrogen gas. This affected the laborers' eyes, and some of them had to go to the hospital for treatment. The work of digging out the material was continued until the lower section reached bed rock, where it was anchored. The sections themselves were tied together with heavy iron rods. After they were firmly in place the interior was filled up with concrete, itself reinforced, so that the foundations became, in reality, a series of huge concrete piles, 8 feet in diameter, anchored to bed rock.

The coaling plants at the two terminals will be the crowning features of the terminal facilities. With an immense storage capacity, and with every possible facility for the rapid handling of coal, both in shipping and unshipping it, no other canal in the world will be so well equipped. The coal storage basin at the Atlantic end will hold nearly 300,000 tons. This basin will be built of reinforced concrete, and will permit the flooding of the coal pile so that one-half of it will be stored under water for war purposes. It is said that deterioration in coal is not as great in subaqueous storage, and at the same time the pile is less subject to fire. The plant will be able to discharge a thousand tons of coal an hour and to load 2,000 tons an hour. Ships will not go alongside the wharves to be coaled, but will lie out in the ship basin and be coaled from barges with reloader outfits. Special efforts have been made to provide for the quick loading of colliers in case of war. The coal

handling plant at the Pacific entrance will have a normal capacity of 135,000 tons and will be able to handle half as much coal in a given time as the one at the Atlantic end.

There will be big supply depots where ships can get any kind of stores they need from a few buckets of white lead to an anchor or a hawser; a laundry in which a ship's wash can be accepted at the hour it begins its transit of the canal, for delivery by railroad at the other end before it is ready to resume its ocean journey; an ice plant which will replenish the cold storage compartments of ships lacking such facilities. In short, it is proposed to attempt to do everything that may be done to make more attractive the bid of the canal for its share of business.

CHAPTER VIII

THE PANAMA RAILROAD

WHEN the United States acquired the properties of the new French Canal Company it found itself in the possession of a railroad for which it had allowed the canal company $7,000,000. This road, in the high tide of its history, had proved a bonanza for its stockholders, and during the 43 years between 1855 and 1898 it showed net profits five times as great as the original cost of its construction.

When the United States took over the road someone described it as being merely "two streaks of rust and a right of way." While the Panama road as acquired by the United States in its purchase of the assets of the new French Canal Company might have been all that this phrase implies, it was none the less as great a bargain as was ever bought by any Government, and probably the greatest bargain ever sold in the shape of a railroad. It was not the rolling stock that was valuable, nor yet the road itself; the real value was to be found in the possibilities of the concession. Not only was this road destined to render to the United States a service in the building of the Panama Canal, worth to Uncle Sam a great many times more than its cost, but it was also destined to yield a net profit from its commercial

operations which in 10 years would amount to double the price paid for it. Since the Americans took it over it has been yielding net returns ranging from a million and a quarter to a million and three-quarters dollars a year. In these 10 years it has brought an aggregate profit of some $15,000,000 into the coffers of the United States.

While $7,000,000 may have been a high price, judged from the standpoint of the physical value of the road, it was a very reasonable one, indeed, as compared with the price paid for it by the new French Canal Company. This company, which sold it to the United States for $7,000,000, paid the Panama Railroad Company $18,000,000 for it 23 years before. When the French Canal Company decided to undertake the building of the canal, it found that the Panama Railroad Company held concessions that were absolutely necessary to the construction of the canal. The Colombian Government had granted the company the concession to complete the road in 1849, and had agreed that no other interoceanic communication should be opened without the consent of the railroad. This gave to the railroad company the whip hand in trading with the canal company and it was able to name its own price.

When the United States wanted to buy the rights and properties of the new French Canal Company the shoe was on the other foot. There was only one buyer — the United States; and it could choose between the Panama and Nicaragua routes. If the United States did not buy the property its principal value would have been what it was worth as an uncertain prospect that at

some future time a second Isthmian canal might be built. That is why the United States was able to buy from the French for $7,000,000 property that they had bought for $18,000,000.

After the United States acquired possession of the railroad, one change after another took place — now in the location, now in the rolling stock, now in directorate, and again in location — until almost all that remained of the original road was its name. It is now built almost every foot of the distance on a new location and the permanent Panama Railroad is a thoroughly modern, well-ballasted, heavy-railed, block-signal operated line of railway, built along the east bank of the Panama Canal from the Atlantic to the Pacific. Nearly half of the old right of way lies on the bottom of Lake Gatun, while the new line skirts that artificial body of water along its eastern shore, at places crossing its outlying arms over big bridges and heavy trestles. The construction of this new line was attended with much difficulty and probably no other road in the world has such a great percentage of fills and embankments in proportion to its length. One embankment, a mile and a quarter long and 82 feet high, required upward of 2,500,000 yards of material for its construction. The road is built about 10 feet above the water's edge, and more than 12,000,000 cubic yards of material was required to make the fills necessary to carry the road bed at this elevation.

When the United States took over the French property it was decided that the canal work and the railroad operations should be maintained as distinct activities. It was agreed that the Canal

Commission should have the right to haul its dirt trains over the Panama Railroad, and in compensation therefor the commission undertook to build a new road to take the place of the old line, which was in the way of the completion of the canal.

The work of relocating the road was undertaken early in the construction of the canal in order that it might be completed by the time the old road had to be abandoned. It was built at a cost of approximately $9,000,000, or close to $170,000 a mile. It is interesting to note that the cost of this thoroughly modern railroad was only about a million dollars more than the cost of the first Panama road which has been built with rather less than usual attention to grades, and with small rails and light bridges. The relocated Panama Railroad was turned over to the railroad company in 1912.

How good a bargain the United States secured when it acquired the Panama Railroad is shown by the fact that during the 10 years of canal work the net earnings of the railroad company have reimbursed the United States for the cost of the old road and the construction of the new one, to say nothing of the invaluable aid rendered in the building of the canal.

The relations existing between the Isthmian Canal Commission and the Panama Railroad Company during the years of the construction of the canal were somewhat peculiar. The Panama Railroad Company is as much the property of the United States as the canal itself, yet the books of the two organizations were kept as carefully sep-

arate and distinct as though they were under entirely different ownership. The Panama Railroad Company, being a chartered corporation, under the terms of its ownership could engage in commercial business with all of the facility of a private corporation. Money received by the Isthmian Canal Commission from outside sources had to be covered into the treasury and reappropriated for distinct and special purposes. On the other hand, the railroad company could use its money over and over again without turning it back into the treasury. This advantage of operation was a useful one in conducting the road itself, and also in the construction of the canal.

There was another reason which led the canal authorities to advocate the maintenance of the two organizations as separate entities. This had to do with the concession rights. Under the terms of the concession of the railroad company the property was to revert to the Republic of Colombia in 1967, or at any earlier date should the company cease to exist as such. While most authorities agree that with the secession of Panama and the setting up of the new Government all of Colombia's rights in the railroad company passed with the territory, and while the treaty between the United States and the Republic of Panama expressly provides that the United States shall have "absolute title — free from every present or reversionary interest or claim" in the railroad, the Republic of Colombia contends that it possesses some rights with reference to the railroad and, not desiring to complicate matters, the canal authorities thought it best to live up to the letter

of the treaty, in spite of Panama's express grant of title free from reversionary interest or claim.

While it was deemed desirable to have the Panama Railroad operated as a separate organization, it was equally important that it should be operated in a way that its interests always would be subordinate to those of the canal. It was decided that the best way to accomplish this was to make the chairman and chief engineer of the Canal Commission the president of the railroad company, and the members of the commission its directors. The stock of the company is held in the name of the Secretary of War, with the exception of a few shares held by the directors to entitle them to membership on the board. There are also a few directors chosen from other parts of the Government service, but their activities are purely perfunctory.

In addition to the railroad, the Panama Railroad Company also operates a steamship line between New York and Colon. This line was acquired with other properties of the new French Canal Company as a part of the Panama Railroad's holdings. There were only a few years during the construction period when this steamship line did not show a loss. But the advantages of having a steamship line for carrying the supplies of the canal were so great, because of the special facilities that could be provided, that the loss was more than compensated by them. During the year 1912 the cost of operating this steamship line was $305,000 greater than the revenues derived from its operation. But, at the same time there was a return of net earnings by the Panama Railroad

of over $2,000,000, at least a part of which was made possible by the operation of the steamship line. Even after deducting the losses sustained in the operation of the steamship company there was a net profit of more than $1,700,000, which for a railroad of less than 50 miles in length is no small item.

As a matter of fact, Government ownership of railways as applied at Panama is remarkably successful from the standpoint of the Government, and partially so to the patrons of the railroad. Probably no railroad in the United States could show net earnings per mile of line anywhere comparable with those of the Panama Railroad.

The rates for passengers and baggage across the Isthmus were rather high for first-class passengers, the fare for the 48-mile trip being $2.40, or 5 cents a mile. The second-class rate was only half as much. On the handling of freight the railroad had to divide the through rate with the steamship companies of the Atlantic and the Pacific, but, while the rates were high, judged by American standards, and the percentages of profits very large, the service maintained was so superior to that encountered on the privately owned railroads of the Tropics that no one ever seriously complained of the charges.

One of the most important services rendered by the Panama Railroad Company in the construction of the canal was in connection with the commissary. It had more to do with the maintenance of a reasonable standard of living cost on the Isthmus than anything else.

When the canal was nearing completion it be-

came advisable to determine what rôle the Panama Railroad should play after the permanent organization went into effect. Should it be continued as a separate entity distinct from the canal but controlled by the canal authorities? Or should it be merged into the Canal Government and operated purely as an auxiliary of the canal with no separate existence? This matter was carefully weighed by the canal authorities and the Government at Washington, and it was finally decided that the best plan would be to operate them as separate entities, but to have all the work done by single organization. Another question that arose was whether the Panama Railroad Steamship Line should be operated as a Government line after the completion of the canal. Recalling the fact that the line never had been a profitable one, and that there was no further reason why it should be continued in operation with an annual deficit, the recommendation was made by the chairman and the chief engineer that the ships should be disposed of and the line discontinued.

As the tide of tourist travel set toward Panama, the serious problem of taking care of thousands of visitors confronted the canal authorities. There were times when every available facility for taking care of lodgers was called into requisition, and still hundreds of American tourists had to find quarters in cheap, vermin-infested native hotels at Colon. Believing that the situation demanded a modern hotel at the Atlantic side of the Isthmus, and having in mind the success of the Government in the construction and maintenance of the Tivoli Hotel at the Pacific side, it was decided by the

Secretary of War that the Panama Railroad Company should build a new hotel at Colon, to be operated by that company for the Government. The result was the beautiful Washington Hotel, in whose architecture one finds the world's best example of northern standards of hotel construction adapted to tropical needs.

Built of concrete and cement blocks, it is constructed in a modified Spanish Mission style that makes it cool and comfortable at all times. Its public rooms, from the main lobby to the dining-rooms, from the ladies' parlor to the telephone and cable rooms, from the barber shop to the billiard room, are large, airy, and most attractively furnished. Its ball room, opening on three sides to the breezes borne in from the Caribbean is a delight to the disciples of Terpsichore, while its open-air swimming pool, said to be the largest hotel swimming pool in the world, affords ideal facilities for those who otherwise would sigh for the surf. Persons who have visited every leading hotel in the New World, from the Rio Grande southward to the Strait of Magellan, say that it is without a superior in all that region and, perhaps, without an equal except for one in Buenos Aires.

Here one may find accommodations to suit his taste and largely to meet the necessities of his pocketbook. The best rooms with bath cost $5 a day for one, or $6 for two. Table d'hote meals are served at $1 each, while those who prefer it may secure club breakfasts and a la carte service. Anyone who has visited the Hotel Washington, situated as it is on Colon Beach, where the breakers sweep in from the Caribbean Sea, feels

that Uncle Sam is no less successful as a hotel keeper than as a builder of canals.

The Panama Railroad, under the American régime, has always looked well after the comfort of its patrons. The coaches are of the standard American type, and enough of them are run on every train to make it certain that no patron need stand for lack of a seat. The most popular trains carry from 8 to 12 cars. These trains are run on convenient schedules, permitting a person to go and come from any point on the road in any forenoon or afternoon. All coaches are supplied with hygienic drinking cups, and in every way the Panama Railroad shows that Uncle Sam is solicitous for the welfare of his patrons.

All the rolling stock on the Isthmus is built on a 5-foot gauge, this having been the gauge of the original Panama Railroad. As the rolling stock of the Canal Commission had to run over the lines of the Panama Railroad, it also was built on the gauge. When this rolling stock is disposed of it will be necessary to readjust the gauge to meet the ordinary American standard which is $2\frac{1}{2}$ inches narrower. It has been estimated that the engine axles can be shortened for $750 per locomotive and those of cars at prices ranging from $27 to $31 per car.

The first attempt to build the Panama Railroad was made in 1847, when a French company secured a charter from the Government of Colombia for a building of a road across the Isthmus. This company was unable to finance the project and the concession lapsed.

In 1849 William H. Aspinwall, John L. Stevens,

and Henry Chauncey, New York capitalists, undertook the construction of the road. The terms of the concession provided that the road would be purchased by the Government at the expiration of 20 years after its completion for $5,000,000. The loss of life in the construction of this road, serious as it was, has been monumentally exaggerated. It is an oft-repeated statement that a man died for every tie laid on the road. This would mean that there were 150,000 deaths in its construction. As a matter of fact, the total number of persons employed during the six years the line was being built did not exceed 6,000. But among these the death rate was very high. Several thousand Chinese were brought over and they died almost like flies. Malaria and yellow fever were the great scourges they had to encounter, although smallpox and other diseases carried away hundreds.

The road was completed in January, 1855. Before the last rail was laid more than $2,000,000 had been taken in for hauling passengers as far as the road extended. The way in which the original 50-cent per mile rate across the Isthmus was established is interesting. The chief engineer encountered much trouble from people who wanted to use the road as far inland as it went from Colon, so he suggested that a 50-cent rate be established, thinking to make it prohibitory. But the people who wanted to cross the Isthmus were willing to pay even 50 cents a mile. Hence for years after the completion of the road the passenger rate continued at $25 for the one-way trip across the Isthmus.

The railroad proved to be such an unexpectedly good investment that the Republic of Colombia began to establish its claim to acquire ownership of the road at the expiration of the 2-year term, which would take place in 1875. It was necessary therefore, that the railroad company should take steps to save the railroad from a forced sale with $5,000,000 as the consideration. Representatives were dispatched to Bogota with instructions to get an extension of the concession under the most favorable terms possible. As it was realized that the Republic of Colombia held the whip hand in the negotiations, the railroad company understood that if it wished to escape selling its great revenue producing road for $5,000,000 it would have to meet any terms Colombia might dictate. The result of this mission was an agreement by the railroad that in consideration of an extension of the concession for a term of 99 years it would pay to the Colombian Government $1,000,000 spot cash and $250,000 a year during the life of the concession. That annual payment was continued as long as the Isthmus remained a part of the Republic of Colombia. Under the terms of the treaty between the United States and the Republic of Panama it was resumed again in 1913, to be paid by the United States to the Republic of Panama throughout all the years that the United States maintains and operates the Panama Canal.

CHAPTER IX

SANITATION

PRIMARILY, the conquest of the Isthmian barrier was the conquest of the mosquito. Not mountains to be leveled, nor wild rivers to be tamed, nor yet titanic machinery to be installed, presented the gravest obstacles to the canal builders. Their most feared enemies were none of these, but the swarms of mosquitoes that bred in myriads in every lake, in every tiny pool, in every clump of weeds on the rain-soaked, steaming, tropical land. For these mosquitoes were the bearers of the dread germs of yellow fever and of malaria; and the conditions that encouraged their multiplication bred also typhoid and all manner of filthy disease. Each mosquito was a potential messenger of death. The buzzing, biting pests had defeated the French in Panama without the French ever having recognized the source of the attack. It was because the Americans, thanks to Great Britain and to Cuba, knew the deadly qualities of the mosquitoes that they were able to plan, under the leadership of Col. W. C. Gorgas, a sanitary campaign of unprecedented success. It achieved two victories. One was that it made of the Canal Zone the most healthful strip of land under tropic skies. The other is the Panama Canal.

When one looks about in an effort to place the credit for these great sanitary achievements he must go back to Cuba, where the yellow fever commission, consisting of Reed, Carroll, Lazear, and Agrimonte, made the remarkable investigations proving that yellow fever is transmissible only through the bite of a mosquito. He must go still further back to Maj. Roland Ross of the British Army, and his epoch-making discovery that malaria is conveyed only by the bite of another kind of mosquito. And, if he is just to all who have contributed to the establishment of the insect-bearing theory of disease, he must not forget Sir Patrick Manson who first proved that any disease could be transmitted by insect bites. It was he who discovered that filariasis is transmissible by this method alone. It was from him that Ross gathered the inspiration that is releasing humanity from one of the most insidious of all the diseases to which mortal flesh is heir. And it was from Ross's malaria discoveries, in turn, that Reed carried forward to successful proof the theory which had persisted in some quarters for generations that yellow fever was transmissible through mosquitoes; a theory already partially proved by Dr. Carlos Finley, of Havana, 20 years earlier.

But all of the surmises and theories came short of the truth until Reed, Carroll, Lazear, and Agrimonte (Lazear at the cost of his life and Carroll at the cost of a nearly fatal attack of yellow fever) took up the work of proving that there was only one way in which yellow fever could be transmitted; namely, by the bite of the mosquito.

COL. WILLIAM C. GORGAS

THE HOSPITAL GROUNDS, ANCON

LIEUT. FREDERIC MEARS

THE OLD PANAMA RAILROAD

Sleeping with patients who had yellow fever, wearing the clothes of those who had died from it, eating from utensils from which yellow fever victims had eaten — in short, putting to the most rigid test every other possible method of infection, they proved by every negative test that yellow fever could not be produced in any way other than by the bite of a mosquito.

The next step was to give affirmative proof that yellow fever was caused by the bite of the female "stegomyia" — she of the striped stockings and the shrill song. This meant that someone had to have enough love for humanity to risk his life by inviting one of the worst forms of death to which human flesh is heir. Those doctors knew that they could not as brave men ask others to undergo the risks that they themselves might not accept, so in a little council chamber in Havana the three Americans — Reed, Carroll, and Lazear — entered into a compact that they themselves would permit infected mosquitoes to bite them. Reed was called home, but Carroll and Lazear stood with the keen and cold eyes of scientists and saw the mosquitoes inject the fateful poison into their blood. Later, after Lazear had died and Carroll had stood in the jaws of death, soldiers of the American army in Cuba volunteered in the interest of humanity to undergo these same risks. And it was thus, at this price, that the world came to know how yellow fever is caused, and that the United States was to be able to build the Panama Canal.

After the guilt of the female "stegomyia" mosquito was firmly established the next problem

was to find a method of combating her work. Dr. Reed and his associates thought that it might be done through a process of immunization, using the mosquito to bite patients with very mild cases and, after the necessary period of incubation, to transmit the disease to those who were to be rendered immune. It was soon found, however, that there was no method of transmitting a mild infection, and the next problem was to combat the work of the mosquito by isolation of yellow fever patients, and by the extermination of the mosquitoes themselves.

In Havana at this time there was another army surgeon who was destined to write his name high upon the pages of medical achievement. He was Dr. William C. Gorgas. Under the patronage of Gen. Leonard Wood, himself a physician and alive to the lessons of the yellow fever commission's investigations, Maj. Gorgas undertook to apply the doctrine of yellow fever prevention promulgated by the commission, and his efforts were attended with brilliant success. The result was that Havana, in particular, and Cuba, in general, were freed from this great terror of the Tropics. When President Roosevelt came to provide for the building of the Panama Canal one of his early acts was to appoint Dr. Gorgas the chief sanitary officer of the Canal Zone.

At first there was difficulty in establishing practical sanitation at Panama. The chief sanitary officer was then a subordinate of the commission, and, along with all of the other men who were trying to do things on the Isthmus, he found

himself hindered by unsatisfactory conditions both as to supplies and as to force; consequently, his work was no more satisfactory to himself than it was to the commission or to the American people. Under these conditions an epidemic of yellow fever broke out in Panama in 1905, and it was not long before the yellow fever mosquito had seemingly established an alibi and had secured a reopening of her case before the jury of public sentiment. People, to emphasize their disbelief in the mosquito theory of the transmission of the disease, tore the screens from their doors and windows, and otherwise proclaimed their contempt for the doctors and their doctrines. This matter went so far that the Isthmian Canal Commission proposed not only a change in method but a change in personnel as well.

At this juncture Charles E. Magoon became governor of the Canal Zone, and he declared that Dr. Gorgas should have adequate financial and moral support. He was determined that the panic which the yellow fever outbreak had engendered should be halted — and a panic it was, for men rushed madly to Colon and defied the efforts of the commission, and of the captains and crews of the Panama Railroad steamships, to prevent them from returning to the States without other transportation arrangements than a determination to get aboard and stay there until the Statue of Liberty had been passed in New York Harbor. So great was this panic that Chief Engineer Stevens declared that there were three diseases at Panama: Yellow fever, malaria, and cold feet; and that the greatest of these was cold feet. The news-

papers of the United States at that time quoted the poetry of such writers as Gilbert, who said:

"Beyond the Chagres River
'Tis said (the story's old)
Are paths that lead to mountains
Of purest virgin gold;
But 'tis my firm conviction
What e'er the tales they tell,
That beyond the Chagres River
All paths lead straight to hell."

It did not matter that in four months there were only 47 deaths on the Isthmus from yellow fever as compared with 108 from malaria in the same period — men do not stop to study mortality tables and to compare the relative fatalities of diseases when yellow fever stares them in the face.

But after all, the yellow fever panic of 1905 served a good purpose, for if the mosquito thereby secured a reopening of its case, it stirred the United States Government to give to the sanitary officers of the Canal Zone the powers they needed, and the means required to prove finally and forever in the court of last resort, the guilt of the mosquito, and to establish for once and all the method of combating its stealthy work.

The whole world recognizes the remarkable results in sanitary work that have been achieved at Panama. While it must be remembered that the population of the Canal Zone is made up largely of able-bodied men, and that, therefore, the death rate naturally would be lower than under like

conditions with a normal population of infancy and old age, the fact remains that sanitary science has converted the Zone from a mosquito paradise of swamp and jungle into a region where mosquitoes have all but disappeared, and where men are as free from danger of epidemic diseases as in the United States itself.

The sanitary statistics of the Canal Zone, and of the cities of Panama and Colon, were based for several years upon an erroneous assumption of population. The Department of Sanitation estimated the population of the Canal Zone by deducting the recorded emigrants from the recorded immigrants and assumed that the difference represented a permanent addition to the Zone's population. Under this method of estimating population a serious error crept in, since hundreds of people came into Panama from the Panaman outports and were recorded as arrivals, but who, departing in small sailing vessels and launches at night after the port officers had gone home, were not recorded as having departed. In this way the sanitary department estimates of population in the Canal Zone reached a total of 93,000 in 1912. The census taken that year showed only 62,000 population in the Zone. This served to make the death rate given out by the Department of Sanitation 50 per cent lower than was justified by actual population conditions.

But one does not need to consider figures to realize what has been accomplished at Panama. Anyone who goes there and sees the remarkable evidence of the success of the efforts to conquer the disease of the tropical jungles, finds a lesson

taught that is too impressive to need the confirmation of medical statistics.

The United States, after the yellow fever outbreak of 1905, never counted the cost when the health of the canal army was at stake. Not only was Uncle Sam successful in his efforts to make the Canal Zone and the terminal cities of Panama and Colon healthful places of abode, but no worker on the canal was denied the privilege of the best medical care. An average of $2,000,000 a year was expended in the prevention of sickness and the care of those who were sick. At Ancon and at Colon large hospitals were maintained where the white American and the West Indian negro had their respective wards. At Taboga a large sanitarium was maintained to assist the recuperation of those who had recovered sufficiently to leave the hospital. Besides this there were rest camps along the line for those not ill enough to be removed to the hospitals, and dispensaries where those who felt they were not in need of other medical attention could consult with the physicians and get the necessary medicines. All medical services to the employees of the Canal Commission and the Panama Railroad were free, and only nominal charges were made for members of their families. No passenger train crossed the Isthmus of Panama without carrying a hospital car for taking patients to or from the hospitals. No way station was without its waiting shed bearing the inscription: "For Hospital Patients Only." Each community had its dispensary, its doctor, and its sanitary inspector.

During the year 1912 there were 48,000 cases

of sickness in the Canal Zone, of which 26,000 were white and 22,000 colored. During the same year 633,000 trips to the dispensaries were made by employees and nonemployees, divided almost evenly between white and colored. The average number of employees constantly sick in Ancon Hospital was 712; in Colon Hospital 209; and in Taboga Sanitarium 54. An average of 119 were in the sick camps all the time and 50 in the quarters. The average number of days' treatment per employee in the hospitals was a little over 14; in the sick camps a little under 3; and in quarters $2\frac{1}{3}$. It cost $160,000 a year to feed the patients in the hospitals and $739,000 a year to operate the hospitals.

The work of sanitation proper cost some $400,000 a year. This includes many items. During one year about 16,000,000 square yards of brush were cut and burned; a million square yards of swamp were drained; 30,000,000 square yards of grass were cut; 250,000 feet of ditches were dug; and some 2,000,000 linear feet of old ditches were cleaned. During the same year nearly a million garbage cans and over 300,000 refuse cans were emptied. In addition to looking after the health of the Canal Zone itself, it was necessary to care for that of the cities of Panama and Colon. In the city of Panama 11,000 loads of sweepings and 25,000 loads of garbage were removed in one year; 3,000,000 gallons of water were sprinkled on the streets and as much more distributed to the poor of the city.

During one year the quarantine service, which keeps a strict lookout for yellow fever, bubonic plague, and other epidemic diseases, inspected

over 100,000 passengers coming into the Zone. It required about 150,000 gallons of mosquito oil a year to keep down the mosquitoes. There are 50 known breeds of these insects on the Isthmus and perhaps some 20 species more which have not been identified. Of the 50 or more species of mosquitoes 11 belonged to the malaria-producing family — anopheles. Their cousins of the yellow-fever-producing family — the stegomyias — boast of only two species. What the other 40 or more kinds are doing besides annoying suffering humanity has not been determined. The mosquito is comparatively easy to exterminate. Its life habits are such that a terrific mortality may be produced among them during infancy. The average young mosquito, during its "wriggler" state of development, lives under the water and has to make about 8,000 trips to the surface for air before it can spread its wings and fly. If oil is poured upon the water it can get no air and death by asphyxiation follows. Two classes of larvaecide are used on the waters to exterminate the baby mosquitoes: One is an oil used to make a scum over the surface; the other a carbolic solution which poisons the water. At the head of every little rivulet and tiny, trickling stream one sees a barrel out of which comes an endless drip! drip! drip! These drops of oil or poison are carried down the stream and make inhospitable all of the mosquito nurseries of the marshes through which the waters flow. In addition to these barrels, men go about with tanks on their backs, spraying the marshy ground and the small, isolated pools of water with larvaecides.

SANITARY DRINKING CUP

MOSQUITO OIL DRIP BARREL

SPRAYING MOSQUITO OIL

TYPICAL QUARTERS OF THE MARRIED LABORER

A NATIVE HUT

This method of treatment has not exterminated all mosquitoes on the Isthmus, but it has so materially reduced their number that one may stay in the Zone for weeks without seeing a single one. This is a freedom, however, that must be paid for by vigilance of the most painstaking and unremitting sort. The moment the work is relaxed the mosquitoes again spread over the territory.

The United States Government will have to continue with the utmost care its work of sanitation and quarantine at Panama. If, after the canal is completed, an epidemic of bubonic plague or yellow fever should break out, it might very seriously interfere with the operation of the canal in several ways. To begin with, it would demoralize the operating force. Further than this, India and China are afraid of yellow fever because in both of these countries the stegomyia mosquito abounds. If the disease should obtain a foothold there it would be difficult to exterminate. Europe, also, might be expected to quarantine against Panama under such conditions. A 10,000-ton freighter carrying cargo through the canal would lose at least a thousand dollars for every day it was detained in quarantine by reason of having visited the canal.

A shrewd observer has said that the successful sanitation of the Isthmus of Panama is a triumph at once of medical science and of despotic government. Probably this does not overstate the case. The methods employed at Panama were arbitrary, and had to be. They probably could not be enforced at all in a democratic community

in ordinary times. The people would rebel against the severity of the regulations and against the incidental invasion of their privacy. But strike any community, however free, with the fear of a swift and deadly disease and it will submit — as witness the shot-gun quarantines that used to demark the northern limits of the yellow fever zone in our own Southern States, or the despotism that governed New Orleans in the terror of 1905. At Panama this fear is ever present, so there is little danger that a responsible majority there ever would resist the sanitary work on the grounds of outraged democracy. It may be that a popular government would become careless, or inefficient, but it would not renounce the pretension. This has been proved in Cuba.

The sanitarians at Panama gave to the workers there a sense of security that contributed no little to the spirit of determination so universally remarked and commended by visitors to the Zone during the era of construction. While there was no immunity from sickness and death, yet there was no panic, no constant dread, such as destroyed the morale of the French force. The Isthmus of Panama still remained hot, its inhabitants still were forced to take the precautions that aliens must take in the Tropics; but they were inspired with a confidence that if these precautions were taken they would not be in any greater danger than if they had remained in their northern homes.

Pestilence, the scourge of the on-sweeping epidemic, the plague of swift death that is only a little worse than the panic of fear it inspires — this was the thing that was stamped out.

Not since the Science of Healing opened its doors to the Science of Prevention have physicians scored a greater victory in their fight against disease and death than on the Isthmus of Panama. Not only did they help to build the canal; they demonstrated that tropical diseases are capable of human control and thereby opened up a vista of hope undreamed of to all that sweltering and suffering mass of humanity that inhabits the Torrid Zone.

CHAPTER X

THE MAN AT THE HELM

IN 1905, William H. Taft, then Secretary of War, made a trip to the Isthmus of Panama to look over the preparations for the construction of the Panama Canal, and at the same time to consider the question of the fortification of the big waterway. On that trip a member of the General Staff of the Army, who at that time was but little known outside of Army circles, went with him. He was a tall, broad-shouldered, bronze-faced, gray-haired man, 47 years old. He came and went unheralded. Few people knew of the engineering record he had made, and no one on the Isthmus dreamed that he was destined to become the commander in chief of the army that would conquer the Isthmian barrier.

He returned to the United States and wrote his report — a report which, from the deep mastery of the subject it revealed, attracted the favorable attention of the Secretary of War. Later when the board of consulting engineers came to make its report upon the type of canal which should be built — whether it should be a sea level or a lock canal — the Secretary of War asked this officer to prepare a draft of his report to the President recommending the lock canal.

Soon after New Year's Day, 1907, the chief

engineer of the canal, John F. Stevens, dissatisfied with the relations that existed between the Government and himself, came to the conclusion that he could not build the canal hampered as he was by red tape at Washington. It then became a question of whether or not the canal should be built by contract or by the Army. President Roosevelt asked for a preliminary report upon this proposition and the unheralded Army engineer who had visited the Canal Zone in 1905, made it. A few days later there was a conference between President Roosevelt, Gen. Alexander MacKenzie, Chief of Engineers of the United States Army, and the Secretary of War. After this conference Maj. George Washington Goethals was summoned to the White House and informed by the President that it had been determined to build the Panama Canal under the auspices of the Army, and that he was appointed chairman and chief engineer of the Isthmian Canal Commission. He was requested to keep the fact of his appointment a secret and to prepare immediately to go to Panama. A ship sailed for the Isthmus three days thereafter, and he was ready to sail when the President advised him that he might wait over and arrange affairs in Washington, leaving in time to get to the Isthmus to take charge on the first of April.

When the announcement was made to the country that the work of building the canal was to be put in the hands of the Army, the whole country began to inquire: Who is Major Goethals? that inquiry revealed the fact that he was a man who had accomplished much in his 49 years. Born in 1858, of Dutch parents, whose ancestors

had settled in New York when it was still New Amsterdam, he was appointed to the United States Military Academy at West Point where he was graduated in the class of 1880 with such honors that he was entitled to enter the Engineer Corps of the Regular Army.

In 1891 he rose to the rank of captain, and in 1898 became lieutenant colonel and chief engineer of the First Volunteer Army Corps in Cuba. On the last day of that year he was honorably discharged from the volunteer service, and, in 1900, became a major in the Engineer Corps of the Regular Army. For a number of years prior to 1898 he had been instructor in civil and military engineering at West Point. He had been in charge of the Mussel Shoals canal construction on the Tennessee River, a work which won praise from engineers both in civil and in military life. It was in a measure his record made on the Tennessee River work that led to his appointment as chairman and chief engineer of the Isthmian Canal.

When he took charge of the work at Panama he was promoted to lieutenant colonel. Arriving there he immediately informed all hands that while the work of building the canal had been placed under Army engineers, no man who was then on the job and faithfully executing his work need fear anything from that administration. From that time down to the last stages of the work that statement held good. Trained at West Point, brought up in the atmosphere of the Army, a lover of its traditions and in full sympathy with its spirit, he laid aside everything that might handicap the success of the undertaking and sought

at once to get the full benefit of all that was best in the Army and in civil life as well. He put his uniform in moth balls when he started to the Isthmus, and from that day to this no man has ever seen him on the Canal Zone wearing an Army uniform.

When he took charge of the big job, the foundations upon which he was to build the superstructure of his success had been laid by his predecessors, but there were many weak points in these foundations as well as many strong ones. With a spirit of utilizing to the fullest extent every advantage that the administrations of the former chief engineers had left on the Isthmus, he undertook to make only such changes as time demonstrated were necessary to the success of the project. At that time 6,000,000 cubic yards of material had been removed from the big waterway. Confronting him was the task of removing some 215,000,000 yards the while building a great dam containing 21,000,000 cubic yards, constructing a series of gigantic locks containing four and a half million cubic yards of concrete, and providing for the happiness and welfare of the sixty-odd thousand people who constituted the canal army and its camp followers.

In the years that followed his appointment he proved himself in every way worthy of his assignment as the managing director of the most stupendous piece of work ever undertaken by man. Furthermore, he established a claim to the title of the "Great Digger." No other man in the history of the world has ever superintended the excavation of an amount of earth half as

great as that which has been taken out of the Panama Canal during his administration. Since he went to the canal to "make the dirt fly" the material excavated under his command, together with that placed in the locks and dams, equals the amount necessary to take out to cut a tunnel 13 feet square through the earth at the Equator.

No man ever carried to a great position less fuss and feathers than Colonel Goethals took to his work as chairman and chief engineer of the Panama Canal. When, during the construction period, one visited his office at Culebra, on almost any afternoon, he would find there an unpretentious little room in the corner of the administration building, about 18 feet square, containing four windows, overlooking the cut from two sides, its painted walls hung with maps, its floors uncarpeted, and in the center a large double-sided, flat-top desk covered with papers. A swivel chair at the desk and two or three other chairs constituted the furnishings of this room. The visitor walked directly into the office of his private secretary and the chief clerk, and if he had anything worth while about which to see the chairman and chief engineer he was detained only long enough for the man ahead of him to get out. With "no time like the present" as his motto in handling the business of his office, he, the busiest man on the Isthmus, and one of the busiest in the world for that matter, always seemed to have more time than many men of lesser responsibilities and far fewer burdens. He once declared that he had a contempt for the man who always tried to make it appear that he was too

busy to see his callers, because his callers were frequently as busy as he himself.

The fact is that he is a man with a very unusual gift in the dispatch of work. System has been the key-note of his success. With thousands of details every day to look after, he has always kept his work so well in hand that to the casual observer he seemed to be the most leisurely man on the Isthmus. He maintained a well-established routine all through his career on the canal. His mornings usually were spent going over the work. When the morning trains passed Culebra at 7 o'clock they found him up, breakfasted, and at the station.

Although these trains carried parlor cars, one would seldom see the chairman and chief engineer riding in them. Rather, he consistently chose to ride in the ordinary day coaches with his sub-engineers, with the steam-shovel men, and with the rank and file of the Americans who made possible the success of the work at Panama. There were few of these Americans whom he did not know by name, and with whom he did not pass a pleasant word whenever he chanced to meet them.

A morning trip over the work with this presiding genius of the big ditch reveals perhaps better than anything else the makeup of the man and the secret of his success.

"Meet me on the early train to-morrow morning at Miraflores," said he to one of his visitors in the early summer of 1913, "and we will go over the Pacific end of the work."

This meant that both the chief engineer and the visitor had to leave comfortable beds at 5

o'clock in the morning to keep the appointment. At 7 o'clock they met at Miraflores. "We will walk through the tunnel if you don't mind," said he, "as I don't want to hold up a dirt train if it can be avoided."

At the other end of the railroad tunnel, the only one on the Isthmus, a railway motor car stood on the siding ready to pick up the distinguished engineer and carry him to the Miraflores Locks. This motor car is something like a limousine on railroad trucks, and was affectionately known by the people on the Isthmus, as "the yellow peril" and "the brain wagon." The first stop was at the concrete work on the spillway dam at Miraflores.

"How soon do you expect to have this dam up to its full height?" he asked of the division engineer who joined him there. "Can't you find room to operate another temporary concrete mixer down there?" he queried further. "Is there anything else you need to keep the work moving forward so as to be certain to complete the dam by the time you promised?"

Going a little farther he came to a place where one division was doing some work for another division. "Don't you think it would be more satisfactory to keep both parts of that work under one division? Why don't you allow it all to be done by the other people?"

Walking across the locks on the temporary bridge the chief engineer and his assistant came to a point where the concrete lamp posts for lighting the locks were being set up. "Don't you think that it would better avoid any settling

if you were to place beams of railroad iron across those spaces and rest the posts on them?" he queried.

A little farther on he met the engineer in charge of the work of the company erecting the gates. "When do you think you will have the gates in the west chambers completed so that we can put the dredge through?" he inquired of Mr. Wright.

"Well, sir," replied Mr. Wright, "if we have good luck I hope to have them done by the first of September; if we have fair luck we ought to have them completed by the middle of September; but at the lowest calculation I can promise them to you by the first of October."

"But have you taken into consideration all of the time you are likely to lose as the result of heavy rains?" queried the chief engineer.

"I have made full allowance therefor, I think," responded Mr. Wright.

Walking on, the watchful eye of the chief engineer fell upon a new baby railway track which was being laid through the eastern lock chambers. "What are you planning to do there?" he asked of the division engineer.

"We wanted to get some additional material through the locks and Mr. Wright informed us that if we would furnish the timbers, he would make it so that we could run these little engines through there," responded the engineer.

"But did you have a definite understanding with him that this should afford no excuse for any further delay in completing the gates?" queried Colonel Goethals.

"We did, sir," responded the division engineer.

"All right then, go ahead."

At this point the party boarded the motor car again and was taken to the big dike which was to hold the Pacific Ocean from flooding the locks after a dike a mile farther down had been blown out. "How much water do you have in the stretch between the two dikes?" he asked of the division engineer. He next wanted to know how many million cubic feet they were able to pump and siphon in, and how much the Rio Grande was bringing in per day. Then he wanted to know if every possible precaution had been taken to insure the watertightness of the new dike; how many thousand pounds of dynamite had been placed under the one to be blown up; how many holes this dynamite was placed in; and a large number of other bits of information which would tell him whether every safeguard had been thrown around the plan to insure its success.

Going up on the other side of the canal the party came to the earth dam joining the west lock walls with the hills, so as to impound 58 feet of water in Miraflores Lake. "How soon do you expect to get that connection made between the lock walls and the dam proper?" he queried of the engineer in immediate charge.

"In four weeks, sir."

"All right," answered Colonel Goethals, "you can't get that done any too soon to suit me."

And so he went over the work around Miraflores from beginning to end, talking now with an Irishman in charge of dumping the material on the inside of the dam, now with a man in charge of some

concrete work, and now with the division engineer himself. By 11 o'clock he had inspected every part of this division and was ready to take his car back to Culebra. In four hours he had seen every man responsible for any important work around Miraflores; had offered a suggestion there, a word of encouragement here, and had obtained a bit of information at another place.

Each day's morning program was like this one except as to the place he visited and the people with whom he talked. One morning he might be tramping over Cucaracha Slide, studying the prospects of its future. Another morning he might be down at Gatun watching an official test of an emergency dam. On these trips he usually wore either a most unmilitary-looking blue serge or gray cheviot, with a somewhat weather-beaten sailor straw hat, and carried a cheap dollar umbrella.

When Colonel Goethals went to the Isthmus he promised that every man with a grievance should have a hearing. Each Sunday morning he had at his office at Culebra what he termed his Sunday "at homes," the best attended functions on the Isthmus, where the blackest Jamaica negro on the job found as much of a welcome as the highest official. These functions were for the purpose of hearing the canal employees who had grievances. Once a visitor was congratulating him upon the smooth manner in which the canal-building machine seemed to be working. "You ought to attend one of my Sunday 'at homes,'" he replied. "You would think that there was no smoothness at all to its running."

Here is the wife of one of the engineers: She wants to find out why it is that she cannot get bread from the Ancon Hospital bakery. She informs Colonel Goethals that Joseph B. Bishop, secretary of the commission, gets bread from the hospital bakery and wants to know why she cannot. "I will look into the matter for you," says the chief engineer, and a note of this complaint is made. Later the telephone bell rings and Mr. Bishop is asked if he gets bread at the hospital bakery. He replies in the affirmative, explaining that about three years ago he had breakfasted with Colonel Gorgas who arranged for him to buy his bread there instead of at the commissary, this bread being more to his liking. "Can't any other employee of the Canal Commission get bread there under the same terms?" queries the chief engineer. "I will see, sir," responds the secretary of the commission. "If they can not," answers the chief engineer, "you must have your bread stopped at once." And it was stopped.

The next person received is the representative of the Kangaroos, a fraternal order. "The Spanish American War veterans get free transportation on a special train on Memorial Day," he is informed, "and the fraternal orders on the Zone are crowded out." "Let a committee of all the fraternal orders appear next Sunday and talk it over with me and we will see what we can do," responds the chief engineer.

Here comes a negro who says that his boss is a tyrant and abuses his men: "I will look into that," responds the presiding genius of the canal, and the Jamaican goes away with an expansive smile on his face.

And so it went. Small affairs, big affairs, and indifferent ones were brought to his attention. In perhaps 80 per cent of them he could not do what was requested, but when able he did it so promptly, and in such a positive, straightforward manner, that his "at homes" have been compared, by the French ambassador to the United States, to the court of justice held by Saint Louis beneath the oak at Vincennes.

A railroad engineer on one of the dirt trains got drunk and ran over a negro. He was sent to the penitentiary. The railroad men issued an ultimatum saying that if he were not released by a certain hour on a certain day, every dirt train on the canal would stop. A committee conveyed this ultimatum to Colonel Goethals and asked his decision. "You will get it at the penitentiary," he replied. "This man will remain in prison and every man who quits work on that account will be dropped from the rolls. There was no strike of engineers.

At another time the waiters at the Tivoli Hotel went on strike. The whole force was promptly discharged, and the official paper of the Canal Commission carried their names with the announcement that thereafter they would not be eligible to employment in any capacity on the Canal Zone.

If the chairman and chief engineer of the canal is just and firm in his relations with his men, he is no less generous in giving credit where credit belongs. Upon one occasion he was talking about the success of the canal project with a friend, and declared that the world would never give to John F. Stevens the credit that was due him in the

construction of the canal. "You know," said he, "the real problem of building this canal has been that of removing the spoil; that problem was preeminently the problem of a railroad man and to solve it demanded the services of one of the best men in the railroad business. We have extended the facilities laid out by Mr. Stevens, and have modified them as experience and conditions have demanded, but they have been operated from that day to this under the general plan of transportation laid out by Mr. Stevens. I do not think that any Army engineer in the United States could have laid out such excellent transportation facilities."

At another time, in discussing this same matter, he declared that it was his firm opinion that the canal could have been built by either of the former chief engineers, John F. Wallace or John F. Stevens, if they had been allowed a free hand. "You see," said he, "they were men who were accustomed to handling big construction jobs. They would outline their project and the cost of executing it to a board of directors who would pass upon it and then leave them absolutely unhampered in the matter of personnel and method, with results as the only criterion of their success. When they came to the Isthmus they found their hands tied by red tape. They had never dealt with a President, a Secretary of War, a Congress, and the public at large. Naturally, they grew restive under the conditions which confronted them and resigned.

"The whole difference is largely that of training. The Army officer knows from the time he leaves

West Point that he has to work in harmony with his superiors, with the President, the Secretary of War, and Congress. That is why we have been able to stay where men from civil life have thrown up the job."

Another remarkable characteristic of the Great Digger is his desire to do his work economically as well as to do it promptly. When he went to the Isthmus there was an insistent demand that the dirt be made to fly. Along with the administration in Washington he realized that the only way to gain the faith and confidence of the people in the work, a faith and confidence essential to its full success, was to measure up to their desire that the dirt begin to fly. It was not a time to consider economies then. But, as soon as those demands had been met and the people had been shown that the Army could make good, a cost-keeping system was introduced. Men doing identical work were pitted against one another; Army engineers were placed in command of one task here and civilian engineers in command of another task there; and thus a healthy rivalry was established.

As Colonel Gaillard, member of the commission, and engineer of the Central Division, testified before a congressional committee, his early work in Culebra Cut was to get out as much dirt as possible, while his later work was given over largely to a study and comparison of cost sheets with a view to cutting down the expense of removing a yard of material, with the result that he was able to show a saving of $17,000,000 in a 9-mile section of the Panama Canal as compared with the estimates of 1908.

In other words, Colonel Goethals took that golden rule of all great soldiers, "get there first with the most men," and adapted it to read "dig the most dirt with the least money." He had ever in mind three things: Safe construction, rapid progress, and low costs. On these three foundation stones in his mind was reared the structure that stands as the highest example of engineering science, and as the proudest constructive accomplishment of the American Republic.

At the northern entrance to the Suez Canal stands a statue of de Lesseps, a beckoning hand inviting the shipping of the world to go through. Perhaps no such statue of Goethals ever will stand at Panama, but there is no need. The canal itself is his monument and its story will ever endure.

CHAPTER XI

THE ORGANIZATION

WHEN the United States finally decided to build the Panama Canal, the next question of gravity which pressed for consideration was the creation of the organization by which it was to be built. Many problems were encountered, and after repeated changes in personnel and rearrangements of duties, the situation finally resolved into an organization headed by one man, clothed with the necessary powers, and held responsible for the consequent results.

The completion of the preliminaries for the acquisition of title to the Canal Zone and to the property and rights of the New Panama Canal Company took place when Congress, on April 28, 1904, made an appropriation of $10,000,000, which was to be paid to the Republic of Panama. Six days later the United States formally took possession of the Canal Zone and of the property of the Panama Canal Company, when at 7:30 o'clock in the morning, Lieut. Mark Brooke, of the United States Army, took over the keys and raised the American flag. The following day President Roosevelt announced the appointment of John Findley Wallace, of Massachusetts, as chief engineer of the canal at a salary of $25,000 a year, the appointment to be effective on the 1st day of June.

The first ship to arrive at Panama carried Maj. Gen. George W. Davis, who was to govern the Canal Zone; Col. William C. Gorgas, who was to make it sanitary; and George R. Shanton, who was to drive out the criminal element. Governor Davis was a member of the Isthmian Canal Commission, Colonel Gorgas had proved his worth in the sanitation of Cuba, and Shanton had been a "rough rider" with Colonel Roosevelt in the Cuban campaign.

When Chief Engineer Wallace arrived on the scene he found there an all but abandoned project. There were hundreds of French houses, but nearly all of them were in the jungle and practically unfit for human habitation. He found millions of dollars' worth of French machinery, but almost none of it in condition to be put into service immediately. He knew in a general way the line of the canal, but surveys were lacking to determine its exact location at every point. With this situation in front of him, he found it necessary to concentrate his efforts upon the problem of getting ready for the work. While he was doing this the people at home began to demand that the dirt fly. Colonel Gorgas also found conditions which challenged his best efforts. Colon was a paradise of disease, Panama was no better. It was only by making both of these cities over again, from a sanitary standpoint, that any hope could be held out for reasonably healthy conditions.

During his stay on the Isthmus Mr. Wallace found himself handicapped at every turn by red tape, a new thing in his experience as a construction engineer. He could buy nothing without

asking for bids; every idea he sought to put into execution had to be submitted to Washington, and he found himself so harassed and handicapped that he wanted a new plan of organization.

Acting in accordance with his recommendations, President Roosevelt decided to accept the resignation of the existing Canal Commission, and to appoint a new one, in which, instead of having independent departments, with the governor independent of the chief engineer, and the chief sanitary officer independent of both the governor and the chief engineer, there should be a more united relation, in which all questions were to be decided by the commission as a whole, the final authority being vested in an executive committee composed of the chairman, the governor of the Canal Zone, and the chief engineer.

Under this plan, the second Isthmian Canal Commission was organized. It consisted of Theodore P. Shonts, chairman; Charles E. Magoon, Governor of the Canal Zone; John F. Wallace, chief engineer; Mordecai T. Endicott; Peter C. Hains; Oswald H. Ernst; and Benjamin A. Harrod. Following the suggestion of Chief Engineer Wallace, the control of the Panama Railroad was also vested in the new commission.

While these changes were being made Chief Engineer Wallace was in Washington. There was dissatisfaction on the Isthmus with an accompanying spirit of unrest, and, to make matters worse, a yellow-fever epidemic broke out. Only a few days after Mr. Wallace reached the Isthmus, he cabled the Secretary of War that he wished to return to Washington, hinting that he might re-

sign. Secretary Taft cabled to Governor Magoon for an opinion as to the motives which were behind this step on the part of Mr. Wallace, and was advised that it was brought about by the offer of a better salary and the fear of the yellow-fever epidemic. When Mr. Wallace reached New York he had a stormy interview with Secretary Taft, who roundly denounced him for quitting at such a critical time. Mr. Wallace declared his lack of confidence in the ability of Colonel Gorgas to control the yellow-fever epidemic, and asserted that the continual interference of red tape was so distracting to him as to make new employment attractive. President Roosevelt upheld his Secretary of War in his denunciation of Mr. Wallace, and promptly appointed John F. Stevens chief engineer at a salary of $30,000.

John F. Stevens arrived on the Isthmus on July 27, 1905. He found the Panama Railroad almost in a state of collapse. He declared that the only claim heard for it was that there had been no collisions for some time. "A collision has its good points as well as its bad ones," he observed, "for it indicates that there is something moving on the railroad."

Mr. Stevens immediately set to work to build up the road, and to provide the means for housing and feeding the canal army. But like his predecessor he found Government red tape hampering, and in his first annual report begged for "a thorough business administration unhampered by any tendency to technicalities, into which our public work sometimes drifts." He protested against civil-service requirements on the Isthmus,

and against the eight-hour working day; and President Roosevelt met his protests by exempting all employees except clerks from the operations of civil-service rules, and by abrogating the eight-hour day.

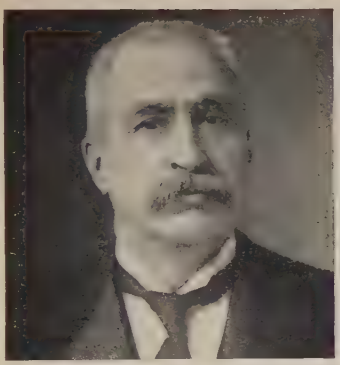
It was under the régime of Mr. Stevens that the question arose as to whether the canal should be built as a sea-level channel through the Isthmus, or as a lock canal with the water in the middle section 85 feet above the level of the sea. President Roosevelt thereupon appointed a board of consulting engineers, made up of 14 members, to visit the Isthmus and determine what type of canal should be built. Five members of this board of consulting engineers were foreigners appointed by their respective Governments at the request of President Roosevelt. They included the inspector general of Public Works of France, the consulting engineer of the Suez Canal, the chief engineer of the Manchester Canal, the chief engineer of the Kiel Canal, and the chief engineer of the Dutch dike system. Three of the American engineers and all five of the foreign engineers voted in favor of a sea-level canal. Chief Engineer Stevens and all but one member of the Isthmian Canal Commission concurred in the vote of the minority, made up wholly of American engineers in favor of the lock canal. President Roosevelt sustained the minority report, and Congress sustained him in the law of June 29, 1906.

In the fall of 1906 Chairman Shonts came out in advocacy of a plan to build the canal by contract. Here arose a difference between Mr. Shonts and Mr. Stevens, and Chairman Shonts

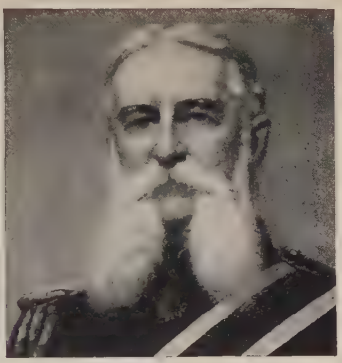
shortly thereafter resigned. A few months later Chief Engineer Stevens also resigned. It is said that his resignation was mainly due to his objection to the appointment of Army engineers as members of the Canal Commission, and to a letter he wrote the President in which he scored the limitations of red tape and Government methods generally. When Mr. Stevens quitted the Isthmus he left behind him the nucleus of the general organization for building of the canal. He saw housing conditions brought up to the required standard, established the necessary commissary where canal employees could supply their needs at reasonable prices, and aided Colonel Gorgas in his fight to make the Isthmus healthful.

At this juncture the organization destined to build the canal was put into effect, with Colonel George W. Goethals at its head. Colonel Gorgas, the chief sanitary officer, was the only important official of the old régime held over. The other members of the commission were Maj. D. D. Gaillard and Maj. William L. Sibert, of the United States Engineer Corps; Civil Engineer H. H. Rousseau, of the United States Navy; and Messrs. J. C. S. Blackburn and Jackson Smith.

Under former commissions the Governor of the Canal Zone had ranked above the chief engineer, and the chairman, the chief engineer, and the governor had had rival powers, which resulted in a great deal of friction. Under the new order the offices of chairman and chief engineer were consolidated, and the governor was reduced to the title of "head of the Department of Civil Administration," reporting to the chairman, as did the



MAJ. GEN. GEORGE W. DAVIS



REAR ADMIRAL J. G. WALKER

THEODORE P. SHONTS

JOHN F. WALLACE

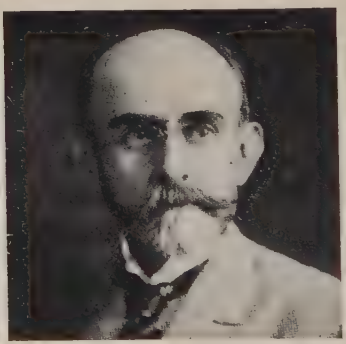
JOHN F. STEVENS

CHARLES E. MAGOON

RICHARD LEE METCALFE

EMORY R. JOHNSON

MAURICE H. THATCHER



JOSEPH BUCKLIN BISHOP

H. A. GUDGER

JOSEPH C. S. BLACKBURN

chief sanitary officer and all of the division engineers.

This commission, in personnel, remained intact during the long period of construction, except for the resignation in 1908 of Jackson Smith, who was succeeded by Lieut. Col. Harry F. Hodges; and for the resignation in 1910 of Mr. Blackburn, who was succeeded by Morris H. Thatcher. Mr. Thatcher, in turn, was succeeded in 1913 by Richard L. Metcalfe as head of the Department of Civil Administration.

During the construction period there were several rearrangements of the duties of the Army engineers associated with Colonel Goethals. From June, 1908, Major Gaillard, afterwards promoted to a lieutenant-colonelcy, was in charge of the ditch-digging work between Gatun and Pedro Miguel, which included the entire Gatun Lake and Culebra Cut sections. It is everywhere admitted that so far as difficulties were concerned, he had the hardest job on the Isthmus, next to the chief engineer. Colonel Gaillard entered the United States Military Academy in 1884 and was graduated with honors entitling him to appointment in the Corps of Engineers. Before being selected as a member of the Canal Commission, he had had much experience in important work. For two years he was in charge of all river and harbor improvement in the Lake Superior region. When he first went to the Isthmus he was assigned as the supervising engineer in charge of harbors, the building of breakwaters, etc.

Lieut. Col. William L. Sibert, another of the Army engineers who was made a member of the

Canal Commission, was graduated from West Point in 1884 and was made a lieutenant of engineers. From 1892 to 1894 he was assistant engineer in charge of the construction of the ship channel connecting the Great Lakes. The four years following he was in charge of the river and harbor work in Arkansas, and following that, spent one year teaching civil engineering in the Engineering School of Application. He then went to the Philippines as chief engineer of the Eighth Army Corps and became chief engineer and general manager of the Manila & Dagupan Railroad. From 1900 to 1907 he was in charge of the Ohio River improvements between Pittsburgh and Louisville. As division engineer of the Atlantic division of the Panama Canal he was in charge of the construction of the Gatun locks, Gatun Dam, and the breakwaters at the Atlantic entrance to the canal.

Civil Engineer Harry H. Rousseau, of the United States Navy, was appointed a member of the Isthmian Canal Commission at the same time that Chief Engineer Goethals was selected to head the organization. He had had much experience in engineering work prior to the appointment and was a personal appointee of President Roosevelt, with whom he had come in contact when he was serving in the Bureau of Yards and Docks of the Navy Department when Mr. Roosevelt was assistant secretary of that Department. He entered the employ of the United States through the civil service, having been appointed a civil engineer in the Navy with the rank of lieutenant, after a competitive examination in 1898. For four

years he was an engineer of the bureau of which he afterwards became chief, and for four years following, from 1903 to 1907, he was engineer of the improvements of Mare Island Navy Yard, California. The duties of Commissioner Rousseau were changed from time to time, and he was finally given charge of the work of constructing the terminals at the ends of the canal. At the same time he was made assistant to the chief engineer, having charge of all mechanical questions arising on the canal.

When Jackson Smith, one of the two civilian members of the Canal Commission, resigned, he was succeeded by an Army officer, Col. Harry F. Hodges, who would have been a member of the commission from the first, upon the request of Colonel Goethals, had not the United States Engineer Corps required his services. Colonel Hodges was graduated from the United States Military Academy in 1881, and immediately entered upon seven years of duty on river and harbor improvements in the United States. This was followed by four years' service as assistant professor of engineering at West Point, and that duty, in turn, by six years of work on rivers and harbors and fortifications. During the Spanish American War he served in Porto Rico, and then returned to river and harbor duty for two years. In 1901-02 he was chief engineer of the Department of Cuba, from which duty he was transferred to the War Department, where he became assistant to the chief of engineers. His experience in river and harbor work, coupled with his success as the designer of the locks of the American Sault Ste.

Marie Canal, fitted him for the work at Panama. He became assistant chief engineer and purchasing agent of the canal in 1907, and the following year was chosen a member of the commission to succeed Mr. Smith. The work of designing the locks and the lock machinery fell upon his shoulders.

When President Roosevelt wanted a man to handle the delicate problems arising out of the peculiar relations with the Republic of Panama and the United States, he selected Joseph C. S. Blackburn, of Kentucky, who had just finished a long term of service in the United States Senate. Senator Blackburn was well equipped for such a position, combining that suavity indicated by the velvet glove with that determination of purpose which lies in the iron hand.

The service of Col. William C. Gorgas, the chief sanitary officer on the Isthmus, began earlier than that of any of the higher officials. He went to the Isthmus immediately after it was taken over by the United States. He has been described as a man "with a gentle manner, but with a hard policy toward the mosquito." He was born in Mobile, Ala., in 1854, the son of Gen. Josiah Gorgas, of the Confederate Army. He became a member of the Medical Corps of the United States Army in 1880, and since his work at the head of the Cuban health campaign his name has been a household word in the United States.

In establishing the Isthmian Canal Commission, which was destined to make the Panama Canal a reality, President Roosevelt selected Joseph Bucklin Bishop as its secretary. Mr. Bishop was made the editor of the Canal Record, a weekly paper

which was the official organ of the Canal Commission. He is a born investigator and when any matter arose concerning the work on the canal, about which the chief engineer desired an impartial report, he usually referred it to Mr. Bishop.

When the matter of organizing the work arose it was decided to arouse a spirit of emulation and rivalry, and S. B. Williamson, a civilian engineer, was put in charge of the Pacific end of the canal, with duties similar to those of the Army engineer on the Atlantic side. Mr. Williamson proved to be a master of the art of accomplishing a great deal with a given amount of money, and the cost sheets of the Pacific end will ever stand as a monument to his efficiency.

The list of engineers and other officials who contributed to the success of the work at Panama is a long one, but among them may be mentioned: Col. Chester Harding, who was the resident engineer at Gatun; W. G. Comber, who headed the dredging work on the Pacific end of the canal during the early days of the American undertaking, of the entire canal during the final stages; W. G. Rourke, who was resident engineer in Culebra Cut for a number of years; Caleb M. Saville, who worked out the data for the construction of the Gatun Dam; H. O. Cole, who succeeded S. B. Williamson on the Pacific end work; Lieut. Frederick Mears, who relocated the Panama Railroad; John Burke, who had charge of the commissary; Maj. Eugene T. Wilson, the chief subsistence officer; Brig. Gen. C. A. Devol, who was in charge of the quartermaster's department; E. J. Williams, Jr., the disbursing officer; and Col. Tom

F. Cook, the picturesque chief of the Division of Posts and Customs.

To all these, and to scores of others who are not mentioned here merely because of the limitations of space, the American people owe the great success at Panama. The organization was imbued with a spirit of loyalty to the great task, and having its accomplishment singly in mind there was little room for jealous bickerings and none at all for scandal and corruption.

Every man who had a part in it always will be proud of his share, and that pride will be supported and justified by all Americans.

CHAPTER XII

THE AMERICAN WORKERS

THE directory, supervisory, and mechanical work in constructing the canal was done by Americans. The engineers, the foremen, the steam shovelers, the operators of spoil trains, the concrete mixers, and, in short, the skilled workers were American citizens; the common and unskilled laborers were West Indians and Europeans. It is to the American workers therefore that the credit is due, for without their direction and aid in every operation the work could not have been done.

Never was there a more loyal, a more earnest, a more enthusiastic band of workmen than these same Americans. The steam shoveler felt as much pride, as much responsibility, in the task as did the chief engineer.

The difficulties under which they labored, the enervating climate, the absence from home, the lack of diversion and recreation, but served to temper the steel in their make-up. The American spirit was there, dominating every detail of the whole big job. Every man was determined to "make good," not for himself alone, but for the organization of which he was a part, and for his country.

In the beginning conditions were bad. There

were few conveniences to make life comfortable, and innumerable inconveniences harassing those who went there. The food was bad and the water was not as good as the food. The quarters were old French houses rescued from the jungle and filled with scorpions.

The result was that few of those who first went to the Isthmus remained, and those who returned to the United States spread far and wide reports of bad conditions on the Isthmus.

With this situation in mind the Canal Commission decided that two things had to be done. Wholesome living conditions had to be created for the people who came to the Isthmus, and a standard of wages had to be set that would prove attractive to good men at home. It was thus that the pay for the Americans on the canal came to be placed at 50 per cent higher than pay for the same character of work in the States. This soon proved a strong incentive to men to leave the States and go to Panama, and as living conditions were improved the number of men willing to accept work on the Isthmus increased.

Two classes of Americans turned their faces toward the Tropics as a result of the inducements held out by the Canal Commission. One was made up of those who were willing to go and stay a year or two, accumulating in that time experience and, perhaps, saving some little money; the other was made up of men whose desire was to go to the Isthmus and stay with the job, utilizing the opportunities it afforded for building up a comfortable bank account.

As the work moved forward those of weak pur-

BRIG. GEN. CARROLL A. DEVOL

AMERICAN LIVING QUARTERS AT CRISTOBAL

HARRY H. ROUSSEAU

LOWERING A CAISSON SECTION

pose and indifference to opportunity gradually dropped out. Their places were taken by others, until through a process of years of elimination there were approximately 5,000 Americans at Panama when the canal was finished; an army was made up almost wholly of men with a purpose in life and consequently of men who could be relied upon to do their work to the best of their ability. The result was that the last years of the task of construction saw every man loyal to his work and anxious to see the job move forward.

American visitors to the Isthmus had occasion to be proud of their countrymen there. Every tourist from a foreign country has commented upon the distinguished courtesy received at the hands of these men. One of them, perhaps England's most noted travel lecturer, said:

"The thing which impressed me more than anything else, outside of the gigantic work and the masterful way in which it is being done, was the exquisite courtesy of every American I met during my stay. I found every one of them not only ready to give such information as he might have but glad to do so. Each man was as proud of the work as if it were his own, and as ready to show his part of it to a stranger as if that stranger were his best friend. It was a delight to me from beginning to end to see the magnificent type of American manhood at work, and the pride taken by every worker in the project."

Every other tourist brought away the same impression. A man who went there without any other credentials than a desire to see the work was

shown the same courtesy and consideration as one with a pocketful of letters of introduction.

The Americans on the Isthmus did not count any hardship too great if it were demanded for the successful prosecution of the work. A case in point is that of J. A. Loulan, the engineer in charge of the rock-crushing plant at Ancon. One morning he was introduced to a visitor from the States who remarked that everything seemed to be running so smoothly that he supposed the work of a supervising engineer was no longer a difficult task. "Well," replied the engineer, "at least it does not pay to worry. Last night at 2 o'clock I was called out of bed by telephone and informed that a Jamaican negro hostler had accidentally knocked the chock from under the wheels of an engine he was firing up, and that it had run down the grade and off the end of the track into about two feet of soft earth. We worked from that time on until breakfast to get the engine back, and were satisfied to know that the accident did not delay the operations at the crusher. Not a man of the force was late getting back to work after four hours of strenuous extra night duty."

Speaking of the patience of the men Commissioner H. H. Rousseau said "The reason for all this is not far to seek; the man who has 'nerves' would never stick it out on a job like this. The climate, the exile from home, and the character of the work all conspire against the man who can not be patient. He soon finds that the Isthmus is no place for him. The result is that a process of elimination has gone on until the men who have 'nerves' have all left and their places

filled with those who are stoical enough to take things as they come."

The Americans on the Isthmus were early risers. The first train from Colon for Panama leaves about 5 o'clock and the first train from Panama for Colon at 6:50. Almost any morning during the construction period one might walk into the dining room at the Tivoli Hotel and see a number of canal engineers breakfasting there who had left Colon on the early train. When one of them was asked if he did not find it something of a hardship to rise so early, he replied:

"Well, you see, from the standpoint of a man just from the States it would seem rather an unheard-of hour for a man to get out and go to work; but we have to meet conditions as we find them down here, and we soon get reconciled to it. There is scarcely a night that I am not called by telephone two or three times, and I have to get up in time to catch the early train several mornings in the week, so I get up at the same hour the other mornings as well. We are well paid, and we owe it to our country to make whatever sacrifices the work demands. And after a month or two we get out of the habit of feeling that it is a sacrifice."

It is this spirit of devotion to the work that enabled the canal authorities to press it to a successful completion with such unprecedented rapidity. These men knew full well that their sacrifices in the interest of progress were appreciated. The most rigid spirit of friendly competition was maintained from the beginning.

The spirit of rivalry nowhere counted for more than among the steam-shovel men. In 1907 it

was decided to publish in the Canal Record the best steam-shovel performances from week to week. This immediately put every steam-shovel gang on its mettle, and soon there was a great race with nearly a hundred entries, a race that continued from that day until the completion of the excavation. The result was that records of steam-shovel performances were made eclipsing everything that had gone before. The average daily excavation per shovel rose from year to year until it was double in the end what it was in the beginning.

As heretofore pointed out, the process of elimination that went on continuously during the construction work sent large numbers of American workers back to the States from the Isthmus. During a single year about three-fifths of the Americans threw up their jobs and returned home. The average stay of Americans during the construction period was about a year. Bachelors were much more given to returning to the States than married men. The endless round of working, eating, sleeping, with its small chance of diversion, made the average bachelor glad to get back to the States within two years. On the other hand, the married men found home life just about as pleasant as in the States. They had with them about 2,000 women, and as many children. Many of the latter were born under the American Eagle at Panama.

The boys who were born there may, if they choose, become native Panamans. The son of a former President of Panama, in talking with Commissioner Rousseau, advised him to make a

Panaman citizen of little Harry Harwood Rousseau, Jr. "You see," said he, and he spoke in all earnestness and seriousness, "he will stand so much better chance of becoming President of the Republic of Panama than of becoming President of the United States."

The American children on the Zone, brimming over with life and health, proved conclusively that the Tropics worked no hardship upon them.

The Canal Commission, from the beginning to the end, made the welfare of the army of workers one of its first cares. As the days of a completed canal approached, every effort was made to enable the employees who had to be laid off to find employment in the States. Provision was made that they could accumulate their leave of absence in such a way as to entitle them to 84 days of full pay after leaving. This was arranged so as to give them sufficient time to establish connections in the States again, without being forced to do it without pay.

Close records also were kept of each employee, and the official immediately over each man was ordered to give him a rating card showing his record on the Canal Zone. No higher credentials could be carried by anyone seeking employment than to have a card from the Canal Commission showing a rating of "Excellent."

Owing to the firmness with which the commission ruled, there was little trouble in the way of strikes. In 1910 a lot of boiler makers who were getting 65 cents an hour on the per diem basis, struck for 75 cents an hour. Their demands were not met and some of them threw up their jobs.

The commission immediately arranged with its Washington office to fill their places, and they had no chance whatever to get further employment on the Isthmus.

The commission was given the power, by President Roosevelt, to order anyone to leave the Isthmus whose presence there was regarded as a detriment to the work. The result was that as soon as any man was found to be fomenting trouble, he was advised that a ship was returning to the United States on a certain date and that it would be expedient for him to take passage thereon. This power of deportation was more autocratic than any like power in the United States, but it proved of immense value in keeping things going satisfactorily at Panama. It was a power whose exercise was called for but few times, since the very fact that the commission had the power was usually a sufficient deterrent.

There are two societies on the Isthmus which tell of the effects of homesickness of the Americans in the employ of the Canal Commission — the Incas, and the Society of the Chagres. The Incas are a group of men who meet annually on May 4th for a dinner. The one requirement for membership in this dining club is service on the canal from the beginning of the American occupation. In 1913 about 60 men were left on the Isthmus of all those Americans who were there at the time of the transfer of the canal property to the United States in 1904.

The Society of the Chagres was organized in the fall of 1911. It is made up of American white employees who have worked six years continuously

on the canal. When President Roosevelt visited the Isthmus in the late fall of 1906 he declared that he intended to provide some memorial or badge which would always distinguish the man who for a certain space of time had done his work well on the Isthmus, just as the button of the Grand Army distinguishes the man who did his work well in the Civil War. Two years later a ton of copper, bronze, and tin was taken from old French locomotives and excavators and shipped to Philadelphia, where it was made into medals by the United States Mint. These medals are about the size of a dollar and each person who has served two years is entitled to one. It is estimated that by the time the last work is done on the canal, about 6,000 of these medals will have been distributed. For each additional two years a man worked, the Canal Commission gave a bar of the same material.

The Society of the Chagres, therefore, is made up of men who have served at least six years, and who have won their medals and two service bars. The emblem of the society is a circular button showing on a small, black background six horizontal bars in gold which are surrounded by a narrow gold border. In 1913 only about 400 out of the many thousands of Americans at one time or another employed in the construction of the Panama Canal were entitled to wear the insignia of this society.

CHAPTER XIII

THE NEGRO WORKERS

THE West Indian negro contributed about 60 per cent of the brawn required to build the Panama Canal. When the United States undertook the work the West Indian negro had a bad reputation as a workman. It was said that he lacked physical strength; that he had little or no pluck; that he was absolutely unreliable; that he was unusually susceptible to disease; and that in view of these things the canal never could be finished if he were to supply the greater part of the labor. But he lived down this bad reputation in large part, and, although it must be admitted that he is shiftless always, inconstant frequently, and exasperating as a rule, he developed into a good workman.

The Government paid the West Indian laborer 90 cents a day, furnished him with free lodgings in quarters, and sold him three square meals a day for 9 cents each, a total of 27 cents a day for board and lodging. On the balance of 63 cents, the West Indian negro who saved was able to go back home and become a sort of Rockefeller among his compatriots. His possible savings, as a matter of fact, were about two and a half times the total wages he received in his native country.

But the sanitary quarters, and the necessarily

strict discipline maintained therein, did not please him. He yearned for his thatched hut in the "bush," for his family, and the freedom of the tropical world. Thus the homesickness of the well-quartered, well-fed negro became a greater hindrance to the work than the ill-fed condition of the "bush dweller." The result was that the commission reached the conclusion that it could better maintain a suitable force by allowing the negroes to live as they chose. Therefore, permission was given them to live in the "bush," and about nine-tenths of them promptly exchanged the sanitary restrictions of the commission quarters, and the wholesome food of the commission mess kitchen, for the *dolce far niente* of the "bush." The result of this experiment in larger liberty was in part a success and in part a failure. The list of names on the roll of workers was largely lengthened, but there was no great addition to the force of the men at work on any given day. It was a common saying in the Zone that if the negro were paid twice as much he would work only half as long. Most of them worked about four days a week and enjoyed themselves the other three. It may be that the "bush dweller" was not fed as scientifically as the man in the quarters, but he had his chickens, his yam and bean patch, his family and his fiddle, and he made up in enjoyment what he lost in scientific care.

Marriage bonds are loose in the West Indies, and common-law marriages are the rule rather than the exception. But, as one traveled across the Isthmus and saw the hundreds of little thatched huts lining the edge of the jungle, he could see

that the families who lived there seemed to be as happy, and the children as numerous, as though both civil and religious marriage ceremonies had bound man and wife together.

When the Americans first began work it was an accepted dictum that one Spaniard or one Italian could do as much work as three negroes. The negroes seemed to be weak. It took six of them to carry a railroad tie where two Spaniards might carry it as well. This belief that the Spaniard was more efficient than the negro stirred the West Indians to get down to work, and in a year or two they were almost as efficient while they were working as were the Spaniards, but the Spaniards worked six days a week while the negroes worked only four.

Of course there were those who spent practically everything as they made it, and they constituted no small percentage of the total negro force. But, on the other hand, some of the negroes were industrious, constant, and thrifty. They saved all they could, working steadily for a year or two, and then went back to Jamaica or Barbados to invest their money in a bit of land and become freeholders and consequently better citizens.

The negro laborers at first were obtained by recruiting agents at work in the various West Indian Islands, principally Jamaica and Barbados. The recruiting service carried about 30,000 to the Isthmus, of whom 20,000 were from Barbados and 6,000 from Jamaica. It was not more than a year or two, however, after the work got under way, until there was little occasion for recruiting. Every ship that went back to Barbados or to

Jamaica carried with it some who had made what they considered a sufficient fortune. Every community possessed those who had gone to Panama with only the clothes on their backs, a small tin trunk, a dollar canvas steamer chair and, mayhap, a few chickens; and who had come back with savings enough to set them up for life. This fired dozens from each of those same communities with the desire to go and do likewise. The result was that the canal employment lists were kept full by those who came on their own initiative.

The terms of entrance to the Canal Zone were easy, the steerage fares were low, and as a result the excess of arrivals over departures sometimes amounted to 20,000 in a single year. The steamship companies had to keep careful and persistent watch to prevent stowaways. Even at that there were hundreds who sought to reach the Isthmus in this way in spite of the fact that they were usually carried back without being permitted to land at Colon.

There was little or no friction between the whites and the blacks on the Canal Zone. This immunity from racial clashes resulted from two causes — one was the incomparable courtesy of the West Indian negro and the other his knowledge that he could expect good treatment only so long as he kept out of trouble. Few of them, indeed, were ever inclined to be offensive. They are usually educated in the three "R's," and are also very polite. Ask one a question and the answer will be: "Oh, yes, Sir," or "Oh, no, Sir," or if he has not understood, "Beg pardon, Sir." He would no more omit the honorific than a Japanese maiden ad-

dressing her father would forget to call him "Honorable."

The different types of West Indian negroes found on the Canal Zone constituted an endless study in human characteristics. They were all great lovers of travel, and no regular train ever made a trip without from two to half a dozen coaches filled with them. After pay day practically every negro on the Zone was wont to get out and get a glimpse of the country.

Without exception they are adepts in carrying things on their heads; consequently, they usually possess an erect carriage and splendid bearing. It is said that the first ambition of a West Indian negro child is to learn to carry things on its head in imitation of its parents. Frequently a negro will be seen with nothing in either hand, but carrying a closed umbrella balanced horizontally on his head. Once in a while one may be seen to get a letter from the post office, place it on top of his head, weight it down with a stone, and march off without any apparent knowledge that he has executed a circus stunt.

Some of the negroes who came to work on the canal never saw a wheelbarrow before arriving there. Upon one occasion some French negroes from Martinique were placed on a job of pick and shovel work. Three of them loaded a wheelbarrow with earth, then one of them stooped down, the other two put the wheelbarrow on his head and he walked away with it. But, with all of his inexperience, the Martinique negro proved to be the best West Indian worker on the canal.

The Martinique negroes were the most pictur-

esque of all the West Indians on the job. The women wore striking though simple costumes, bandana handkerchiefs around their heads, and bright-colored calico dresses usually caught up on one side or at the back, thus anticipating the Parisian fashion of the slit skirt by many years.

A large number of the negroes lived in small tenement houses built by private capital, and oftener than not one room served the entire family. Nearly every one of the American settlements had its West Indian quarter where these buildings and the Chinese stores flourished to the exclusion of everything else. At the Pacific end of the Panama Railroad there was a suburb known as Caledonia, which was given over almost entirely to West Indian families. One could drive through there any day and see half-grown children dressed only in Eden's garb. In other parts of the canal territory one saw very few naked children except in the back streets of Colon.

The Government took the best of care of the negroes on the work during the entire construction period. There were hospital facilities at both ends of the canal and sick camps along the line. The commissary protected them against extortion by the native merchants and gave them the same favorable rates enjoyed by the Americans. The color line was kindly but firmly drawn throughout the work, the negroes being designated as silver employees and the Americans as gold employees. The post offices had signs indicating which entrances were for silver employees and which for gold employees. The commissaries had the same provisions, and the railroad company made the

general distinction as much as it could by first and second class passenger rates. Very few of the negroes ever made any protest against this. Once in awhile an American negro would go to the post office and be told that he must call at the "silver" window. He would protest for awhile, but finding it useless, would acquiesce.

The idea of speaking of "silver and gold employees," rather than black and white employees, was originated by E. J. Williams, Jr., the disbursing officer of the Canal Commission. He first put this designation on the entrances to the pay car and it was immediately adopted as the solution of the troubles growing out of the intermingling of the races.

One of the most interesting experiences that could come to any visitor to the Isthmus was a trip across the Zone on the pay car; to see 24 tons of silver and 1,600 pounds of gold paid out for a single month's work; and to watch the 30,000 negroes, the 5,000 Americans, and the 3,000 or 4,000 Europeans on the job file through the pay car and get their money. The negroes were usually a good-natured, grinning lot of men and boys, but they were wont to get impatient, not with the amount of money they drew but with its weight. Under an agreement with the Panama Government the Canal Commission endeavored to keep the Panaman silver money at par. Two dollars Panaman money was worth one dollar American, and the employees were paid in Panaman coin. Thus a negro who earned $22 during the month would get 44 of the "spiggoty" dollars. These "spiggoty" dollars are the same

size as our own silver dollars and to carry them around was something of a task.

When the negroes were asked what they proposed to do with their money the almost invariable reply was: "Put it to a good use, sir." American money was always at a premium with them and the money-changers in the various towns usually did a land-office business on pay day.

Paper money was not used on the pay car at all. In the first place, there was always danger of its blowing away, and in the second place paper money in the hands of negro workmen soon assumed a most unsanitary condition. The negroes were always desirous of getting American paper money because they could send it home more cheaply than gold.

Large numbers of West Indian women, the majority of them with their relatives, lived on the Zone during the construction period. They were for the most part industrious and made very good household servants. They were nearly always polite and deferential, some of them even saying, "Please, Ma'am," when saying "Good morning."

It was a rare experience to travel on a ship carrying workers to the Canal Zone from the Islands of the West Indies. Ships calling at Kingston, Jamaica, would usually take on a hundred or more passengers. They would be quartered either forward or aft on the main deck. They would carry aboard with them all kinds of small packages. Some would have small boxes of chickens or pigeons, and some little old sawbuck-fashioned folding beds covered with canvas. As soon as inspected by the doctor for trachoma each negro would

select the most favorable spot, gather his furniture around him, and settle down in one place, there to remain almost without moving during the whole of the 40-hour trip across the Caribbean. When the water was fine and the sailing smooth the first cabin passengers might conclude that they were carrying a negro camp meeting. On the other hand, if the weather were bad and the sea rough, a sicker lot of people nowhere might be found. One of the favorite negro preventives of seasickness is St. Thomas bay rum applied liberally to the face, although to the on-looker it never seems to prevent or cure a single case.

Before landing at Colon every one of these negroes had to be vaccinated. Almost without exception they tried to prevent the virus "taking" by rubbing the scarified spot with lime juice or with some other preparation. Meals on board generally consisted of rice and potatoes, and, perhaps, coffee and bread. One might see a dozen young girls in a group eating with one hand and with the other polishing their complexions with the half of a lime.

With all his faults — and they were not few — the West Indian negro laborer probably was the best workman that could have been employed for the job at Panama. He was usually as irresponsible, as carefree, and yet as reliable a workman as our own American cottonfield hand. He made a law-abiding citizen on the Zone, was tractable as a workman, and pretty certain always to make a fair return to the United States on the money it paid him in wages.

Under the firm but gentle guidance of the

master American hand, he did his work so well that he has forever erased from the record of his kind certain charges of inefficiency and laziness that had long stood as a black mark against him.

The Canal Commission so appreciated his good work that it made arrangements to return him to his native country when his services no longer were required, there to take up the life he led before he heard the call of the "spiggoty" dollars that took him across the Caribbean.

He will miss the life on the Isthmus. He was worked harder, he was treated better, and he was paid higher wages there than he ever will be again in his life. Perhaps he has saved; if so, he retires to be a nabob. Perhaps he has wasted; if so, he must go back to the hand-to-mouth existence that he knew in the days before.

But after all, the experience of the thousands of West Indian negroes employed on the canal will have a stimulating effect on their home countries, and their general level of industrial and social conditions will be raised.

At any rate, the American Republic always must stand indebted to these easy-going, care-free black men who supplied the brawn to break the giant back of Culebra.

CHAPTER XIV

THE COMMISSARY

TO BUILD the canal required the labor of some fifty thousand men. To induce these men to go to Panama, to stay there, to work there, and to work there efficiently, was no light undertaking. Health was promised them by the most efficient sanitary organization that ever battled with disease. Wealth was promised them, relatively speaking, in the form of wages and salaries much higher than they could obtain at home for the same work. But health and wealth, much desired and much prized as they are, can not of themselves compensate for transplanting a man to an alien shore and an alien atmosphere, especially if that shore be tropic and that atmosphere hot. There must also be comfort.

And comfort was promised to the canal diggers by the commissary department. Good food at prices cheaper than one pays in the United States, and quarters of the best — these things the commissary held out as a part of the rewards at Panama.

Of course this was not the chief object of the commissary department — it was the incidental factor that in the end almost obscured the main issue. The main business was so well done that everybody took it for granted, just as no one will

remark about the sun shining although that is the most important fact we know. The main business of the commissary was to keep the canal diggers fed and housed so that they would have the strength for their tasks. How this was done, how fresh beef and ice cream were made daily staples in tropic Panama, how the canal army was fed, is a big story in itself.

The history of the French régime was such as to prejudice the whole world against the canal region and to deter any but the most adventurous spirit from entering there into a gamble with death. The Americans soon found that without extraordinary inducements it would be next to impossible to recruit a force able to build the canal. Therefore it was determined to make the rewards so great that extra dollars to be gained by going to Panama would outweigh the fears of those who had any desire to go. It was decided to pay the employees of the Canal Commission and the Panama Railroad Company wages and salaries approximately one-half higher than those obtaining at home for the same work. Furthermore, it was decided that the Government should furnish free quarters, free medical service, free light, and other items which enter into the expense budget of the average family. It was found advisable to establish Government hotels, messes, and kitchens, where the needs of every employee from the highest officer to the most lowly negro laborer could be met, and to operate them at cost.

Still another problem had to be faced; that of providing places where the people employed in building the canal could escape from the high

prices fixed by the merchants of Panama and Colon. With this end in view, a great department store, carrying upward of 5,000 different articles, was built at Cristobal. This store established branches in every settlement of canal workers where patrons could go to ship and receive the benefit of prices much lower than those prevailing with regular Panaman merchants.

Anyone who will study carefully the annual reports of the operation of the commissary of the Panama Railroad Company, will realize what great profits are made by the various middlemen in the United States who handle food products between the producer and the consumer. In 1912 the commissary had gross sales amounting to $6,702,000, with purchases amounting to $5,325,000. This represents a gross profit of 26 per cent. The cost of transportation from New York and distribution on the Isthmus, amounted to about 24 per cent, leaving a net profit of approximately 2 per cent on the sales of goods. When it is remembered that transportation of commissary products from New York amounted approximately to a quarter of a million dollars a year, and that wagon deliveries on the Isthmus added $50,000 a year to this, it will be seen that the expenses of distribution at Panama were approximately on the same footing with those in the United States.

In the case of dressed beef, one finds a most illuminating example of how it is possible to sell the ordinary items of a family budget to the consumer at rates much lower than those obtaining in the United States. According to the most authentic information dressed beef laid down at Panama

costs more, quality for quality, than it costs the ordinary retail butcher in the States. At one time in 1912 the commissary was paying $11.94\frac{1}{4}$ a hundred pounds for whole dressed beeves laid down in New York. This was for the best corn-fed western steers, a grade of beef that is found only in the best retail butcher shops of any American city. Yet, with the expense of ocean-refrigerator carriage added, and with other operating costs equal to those of the retail butcher in the States, the commissary found it possible to sell to the consumer, delivered at his kitchen door, porterhouse steaks from this beef at 20 cents, sirloin steaks and roasts at 19 cents, and round steaks at 13 cents a pound. At this same time the average American housewife was paying from 26 to 30 cents for porterhouse steaks, from 22 to 26 cents for sirloin steaks and roasts, and from 17 to 22 cents for round steaks; and in the butcher shops in the United States where grades of meat comparable to those at Panama were handled the figures were usually around the top quotations.

One cannot escape asking the question how it is that if the Panama Railroad commissary could pay approximately 12 cents a pound for dressed beef at New York, deliver it in refrigeration at Cristobal, thence to the housewife by train and wagon, and make a gross profit of some 26 per cent by the operation, that the American retail butcher can reasonably claim that at the price he sells his meat he is making little or no net profit.

One finds the same scale of prices on other commodities at Panama as meats. Only the very best goods are handled in the commissary. Any

reasonable need of any employee could be supplied by the commissary at prices probably lower than a retail merchant in the United States could buy the same commodities.

A few instances of how the commissary fared when its supply ran short will serve to illustrate the grasping disposition of the average Panaman merchant.

In one case high waters in the Chagres interrupted traffic on the Panama Railroad, and the price of ice in Panama City promptly jumped from 50 cents to $1 a hundred pounds. At another time a ship bringing coffee to the Isthmus ran aground and the commissary had to buy coffee in the Panama market. It had to pay 6 cents a pound more at wholesale for the coffee than it was selling for at retail in Panama the day before the ship went aground. On another occasion a vessel carrying a supply of milk went ashore and the wholesale price of that commodity jumped a hundred per cent overnight. The Panaman merchants made a long and persistent fight to get the privilege of doing the business which is done by the commissary, but the canal officials were too wise to allow the working force to be dependent upon native business men for family budget needs.

Although the commissary did an annual business of nearly $7,000,000 a year during the height of the construction period, it received comparatively little actual money for the commodities it sold. A great deal of this business was with the subsistence department of the Canal Commission, furnishing supplies for the hotels, European laborers' messes, and common laborers' kitchens.

Practically all of the remainder was with the employees of the commission, and was done through coupon books. When an individual wanted to buy from the commissary he asked that a coupon book be issued him. If it were found that he had sufficient money coming to him for services rendered to cover the cost of the book, it was issued to him and the clerk in the commissary detached coupons to cover the purchases. When the monthly pay roll was made up, the cost of the coupon books was deducted from the amount due the employee for services. Many employees and their families lived too far away from the commissaries to make daily visits, so they simply deposited their coupon books with the main commissary at Cristobal and sent their orders in by mail from day to day. The commissary clerks would fill these written orders, sending the goods out on the first train.

In addition to buying and selling products for the benefit of the canal workers, the commissary operated a number of manufacturing establishments. It had a bakery using some 20,000 barrels of flour, baking 6,000,000 loaves of bread and other things in proportion annually; an ice-cream plant freezing 138,000 gallons of ice-cream annually; a laundry washing 4,250,000 pieces a year; a coffee-roasting plant; and a large cold-storage warehouse. About 70,000 people were constantly supplied with commodities from the commissary.

In its efforts to meet the needs of the several classes of employees on the Canal Zone the commission established four different kinds of eating

places, — a large general hotel, a score of line hotels, Spanish messes, and West Indian laborers' kitchens. At Ancon it built the large Tivoli Hotel costing half a million dollars, for the accommodation of visitors; and of those high-class employees who desired modern hotel facilities. This hotel is the social center of the Canal Zone. Here practically all of the tourists come and stay while on the Isthmus.

During the year 1912 this hotel cleared $53,000 in its operations. The cost of the supplies for the meals served, of which there were 161,000, was approximately 51 cents per meal. The cost of services was approximately 19 cents, making a total of 70 cents per meal. The rates were $3 up to $5.50 a day, employees being given special concessions.

The line hotels were, more properly speaking, merely dining-rooms where the American employees were furnished substantial meals for 30 cents each. Outsiders paid 50 cents each for these meals. They were up to a very high standard. Once the late Senator Thomas H. Carter, of Montana, was a member of a Senate committee visiting the Isthmus and he invited the subsistence officer, Maj. Wilson, to come to Washington and show the manager of the Senate restaurant how to prepare a good meal. A year later, after Senator Albert B. Cummins, of Iowa, had eaten one of the lunches at Gatun, he renewed the invitation of Senator Carter, telling Maj. Wilson he was sure that if he were to come Senators would get better meals for their money. At one of the Congressional hearings on the Isthmus Representative T. W. Sims,

JOHN BURKE

MEAL TIME AT AN I. C. C. KITCHEN

WASHINGTON
HOTEL, COLON

MAJOR EUGENE
T. WILSON

THE TIVOLI HOTEL, ANCON

of Tennessee, asked that the menu of a meal he had eaten at one of these hotels be inserted in the record. Major Wilson inserted the menu for several days instead. The following is the menu at the Cristobal Hotel for January 20, 1912:

Breakfast. — Oranges, sliced bananas, oatmeal, eggs to order, German potatoes, ham or bacon, hot cakes, maple sirup, tea, coffee, cocoa.

Lunch. — Vegetable soup, fried pork chops, apple sauce, boiled potatoes, pork and beans, sliced buttered beets, stewed cranberries, creamed parsnips, lemon meringue pie, tea, coffee, cocoa.

Dinner. — Consomme vermicelli, beefsteak, natural gravy, lyonnaise potatoes, stewed beans, sliced beets, stewed apples, carrots a la Julienne, hot biscuits, ice-cream, chocolate cake, tea, coffee, cocoa.

The line hotels in 1912, which were operated at a loss of $12,000, served over 2,000,000 meals. The cost of the supplies per meal amounted to $0.2504 and the service to $0.0165, making the average meal cost $0.3065, while the employees were charged 30 cents. Approximately 2,000 Americans were continuous patrons of the line hotels.

The messes for European laborers were operated in 1912 at a total cost of $405,000. The returns from their operations amounted to $443,000, showing a net profit of $38,000 on 1,108,000 rations. The net profit per day's ration approximated $3\frac{1}{2}$ cents. The supplies entering into the ration cost $0.3106 and the service of preparing it $0.0547.

The national diet for Europeans would appear very monotonous to Americans. For the Span-

iards who constituted the major portion of the European employees, it was a "rancho," which is a mixture of stewed meat, potatoes, cabbage, tomatoes and garbanzos heavily flavored with Spanish sweet pepper. Their soups were made very stiff, really a meal in themselves, since they were about the consistency of Irish stew mashed up. A day's ration for Spanish laborers ran about as follows:

Breakfast. — Roast beef, pork sausage, corned-beef, sardines or bacon, one-half loaf of bread, chocolate and milk.

Dinner. — Garbanzos or macaroni, roast beef or hamburger steak, fried potatoes, oranges or bananas, one-half loaf of bread, coffee.

Supper. — Rice soup, peas or beans, rancho, one-quarter loaf of bread, tea.

The Government charged the European laborers 40 cents a day for their meals. Their mess halls were large, airy, comfortable and conspicuously clean. The European laborers nearly all patronized these mess halls; about 3,200 of them constantly were fed at these places.

Wherever there was a West Indian negro settlement along the line of the canal the commission operated a mess kitchen. These kitchens were kept scrupulously clean and the laborers were furnished meals at 9 cents each. Each laborer who patronized the kitchen had his little kit into which the attendants put his meal, and he could carry it anywhere he desired to eat it. In spite of the fact that these meals corresponded almost exactly to the American Regular Army field rations, they were never popular with the West Indian negroes. Although there were some 25,000 of

these laborers on the canal in 1912, only a little more than a half million rations were issued to them during the year. Less than 15 per cent of the negro force patronized the commission kitchen.

The following is a specimen day's ration in a West Indian kitchen:

Breakfast. — Cocoa and milk, porridge, bread, jam.

Dinner. — Pea soup, beef, doughboys, rice, bread, bananas.

Supper. — Stewed beef, boiled potatoes, stewed navy beans, bread, tea.

During the construction period of the canal the average American received approximately $150 a month for his labor. Those who were married and remained in the service a reasonable time were provided, rent free, with family quarters. Their light bills were never rendered, the coal for their kitchen stoves cost them nothing, and the iceman never came around to collect. The bachelors were provided with bachelor quarters with the necessary furniture for making them comfortable. The average married quarters cost from $1,200 to $1,800 each, and the average quarters for a bachelor about $500 to construct. The higher officials had separate houses; lesser officials were furnished with semi-detached houses. The majority of the rank and file of American married employees were housed in roomy, four-flat houses. The verandas were broad and screened in with the best copper netting, and all quarters were provided with necessary furniture at Government expense.

The assignment of quarters and furniture called for a great deal of diplomacy on the part of the quartermaster's department, since, if Mrs. Jones happened to visit Mrs. Smith, and found that she had a swell-front dresser in her bedroom, while her own was a straight-front dresser, an irate lady was very shortly calling on the district quartermaster and demanding to know why such discrimination should be practiced. Perhaps she had been on the Canal Zone longer than Mrs. Smith, and felt that if anyone were entitled to the swell-front dresser she was the one. The district quartermaster had to explain with all the patience at his command that it was not a case of discrimination but merely that the commission had bought swell-front dressers at a later date for the same price that it formerly had paid for the straight-front ones, and that consequently the people who furnished houses later got them.

On another occasion Mrs. Brown, calling on Mrs. White, found that Mrs. White had an electric light on her side porch. She immediately fared forth to pull the hair of the quartermaster for this discrimination, but was somewhat taken back when that official calmly informed her that the light had been put there for a few days in anticipation of a children's party that was to be given by Mrs. White one night that week.

The marvelous success of the commissary, not only in affording its patrons better service at lower prices, but also in making a substantial profit on the undertaking, had been referred to as the most valuable lesson taught by the whole

canal digging operation. It has proved the efficiency of government agencies in fields far removed from the ordinary operations of government, and it may be that its experience will be used to advantage in combating the high cost of living in the United States itself.

CHAPTER XV

LIFE ON THE ZONE

TRANSPLANT a man or a woman from a home in a temperate climate to an abode in the Tropics, and there is bound to be trouble. Disturbances in the body are expected and, proper precautions being taken, most often are warded off. Disturbances in the mind are not anticipated, preventive measures are seldom taken, and there comes the trouble. That is why the Young Men's Christian Association and the American Federation of Women's Clubs had their part to do in digging the Panama Canal, a part second in importance only to the sanitary work under Colonel Gorgas.

It's an odd thing — this transplanting a man from the temperate to the torrid zone. It affects men of different nations in different ways. It is disastrous in inverse ratio to the adaptability of the man transplanted. A German or a Dutchman goes to the Tropics and almost without a struggle yields to the demands of the new climate all his orderly daily habits. Your Dutchman in Java will, except on state occasions, wear the native dress (or undress); eat the native food; live in the native house; and, like as not, take a native woman to wife. One thing only — he will retain his schnapps. The German is only a little less

adaptable, clings only a little longer to the routine of the Fatherland, but he, too, keeps his beer.

Your Englishman, on the contrary, defies the tropical sun and scorns to make any changes in his daily habit that he had not fixed upon as necessary and proper before he left his right little, tight little, island. He does, it is true, wear a pith helmet. That is due partly, perhaps, to his fear of the sun, but it is much more due to the fact that he associates it with lands where faces are not white; therefore he wears it in Egypt in the winter when it is shivery cold with the same religious devotion that he wears it in India when the mercury is running out of the top of the thermometer. Your Englishman, it is true, wears white duck clothes in the Tropics, but not the fiercest heat that old Sol ever produced could induce him for one moment to exchange his flannel underwear for cotton or to leave off his woolen hose. It is a pretty theory and not without much support, that it is this British defiance of tropical customs that has given him the mastery over Tropic peoples. And wherever goes the Briton there goes also Scotch-and-soda.

The Americans steer a middle course. They dress for the heat and make themselves comfortable as possible. They consume even greater quantities of ice than they do at home, and the average American eats every day in summer enough ice to kill a score of Englishmen. At least, that's what the Englishmen would think.

But the American in the Tropics tenaciously clings to many of his home habits, despite the changed conditions of his place of sojourn. He

must have his bath, even though he talks less about it than the Englishman. He must have his three square meals a day, and breakfast must be a real breakfast. He demands screens to protect him from pestiferous insects, no less for comfort's sake than health's. And then he demands two other things — a soda fountain and a base-ball team.

It is true that he often will indulge in a British peg of Scotch-and-soda, or in a German stein of beer, but the native drink that he takes with him to the Tropics, and one that he alone consumes, and the one that he, in season and out of season, demands, is the sweet, innocent, and non-alcoholic product of the soda fountain. How incomprehensible is this to the sons of other nations no American may ever understand.

It may seem to be going far field to discuss even in the general way the differing tempers of men of different nations transplanted from a temperate to a torrid clime. But, as a matter of fact, it has a direct bearing on the accomplishment at Panama, of which Americans are so proud.

When the Americans first undertook the task, the denizens of the Isthmus prepared for them only such entertainment as had been acceptable in other days. The only places open to the tired worker in the evening were the saloons, selling bad whiskey and worse beer; or darker hells of sure and quick damnation. There were no theaters that would appeal to the American taste, no sports that the clean American would tolerate. In short, when the American in the early days of the construction was wearied with that weariness

FLOYD C. FREEMAN

I. C. C. CLUB HOUSE AT CULEBRA

A. BRUCE MINEAR

READING ROOM IN THE I. C. C. CLUB HOUSE, CULEBRA

that would not respond to resting, there was but one thing left. He got home — sick and drunk.

In those early days there were few women. Most of the men who came then were moved rather by a spirit of adventure than by a determination to share in a tremendous job of work, and such men were not married. It was not long until the men at the head discovered that the married men were more content, that they lost less time from the work, and produced more results when on the job than did the bachelors. (This, of course, must not be taken as an indictment against every individual bachelor who worked at Panama, but rather as a characterization based on the average of that class.) Thus in the very order of things it became the policy of the commission to encourage unmarried men at work to marry, and to bring married men from the States rather than bachelors. Inducements were held out, putting a premium on matrimony. The bachelor worker had good quarters, but he perhaps shared but a room in a bungalow, whereas the married man had a four-room house of his own, with a big porch, and free furniture, free light, and the problem of the cost of living solved by the paternal commissary.

So matrimony flourished. But when the women came in increasing numbers, and with them many children, another problem arose. Women born in temperate climes suffer more in the Tropics than do men. The dry, dry heat of the dry season is succeeded by the wet, wet heat of the rainy months. There is never any escape from that horrible, hateful, hellish heat. Is it to be baked

or steamed? The changing seasons offer no other alternative. And the Fear! Not for a moment may one forget that sickness and death stalk in the jungle; that a glass of water or an unscreened door may be the end of it all. There is no normality, no relaxation, no care free rest for the woman in the Tropics.

At Panama her housekeeping duties were lightened by the excellence of the commissary system, so that they were not enough to keep her mind occupied. She became homesick and hysterical.

So, then, it being desirable to have married men on the job, it became necessary to do something to keep the women at the minimum stage of unhappiness. The Y. M. C. A clubhouse, with their gymnasiums, their libraries, their games, their sports, and their clubiness, had been the substitute for home offered to the lonely American man at Panama. The Civic Federation was invited to do what it could for the women. It sent an agent of the American Federation of Women's Clubs to Panama, who organized women's clubs, and these, by putting the women to work, made them, in a measure, forget the Heat and the Fear.

Miss Helen Varick Boswell visited the Isthmus in the fall of 1907 and assisted the women in forming their clubs. She found them literally hungry for such activities and they responded with a will to her suggestion. The result was frequent meetings in every town in the Canal Zone and innumerable activities on the part of the women interested in club work.

The transformation was most remarkable.

Where almost every woman on the Isthmus seemed to be unhappy, now everyone who needed an outlet for her mental and social instincts found it in club work. Where once they quarreled and disputed about their house furnishings, life on the Isthmus, and the general status of things on the Canal Zone, now the women seemed to take a happy and contented view of things, and became as much interested in the work of building the canal as were their husbands, their fathers, and their brothers. Looking back over the task, and realizing how much longer the married men stayed on the job, and how much more essential they were to the completion of the canal than the bachelors, the cares of the canal authorities to keep the women satisfied was a master stroke.

When the club movement was launched one of the first steps was to organize classes in Spanish. Women from every part of the Zone attended these Spanish classes and took up the work of learning the language with zeal. Comparatively few of them had any opportunity to learn Spanish, even in its most rudimentary form, from household servants, since the same lethargy that characterized the native men of Panama, and made them totally indifferent to the opportunities for work on the Canal Zone, also characterized the Panaman women, with the results that most of the American households at Panama had English-speaking Jamaican servants instead of Spanish-speaking Panamans.

The servant problem was not as serious as it is in the average American city. There was always a full supply of Jamaican negro women

ready for engagement as household servants. They were polite and efficient. Almost without exception they had a deeply religious turn of mind, although they might transgress the Mosaic law far enough to substitute plain water for violet water on the boudoir table of their mistresses. Usually they were very neat of person and very careful in the manner of doing their work. The wages they commanded were approximately equal to those asked in the ordinary American city.

The greatest social diversion of the Isthmus, of course, was dancing. Every two weeks the Tivoli Club gave a dance at the Tivoli Hotel. Trains to carry visitors were run all the way across the Isthmus and no American ever needed to miss a dance at the Tivoli Hotel because of unsuitable railroad accommodations.

Each small town had its own dancing clubs and in those towns where there were Y. M. C. A. buildings, the dances were held in them. The new Hotel Washington proved a very popular rendezvous for the dancers, and in the future the big functions of this kind probably will alternate between the Tivoli at one end of the canal and the Washington at the other.

The university men maintained the University Club in the city of Panama, directly on the water front. This club frequently opened its doors to women and its functions were always regarded as events in Isthmian social history. In Colon there was organized several years ago a club known as the Stranger's Club. This club, as did the University Club at Panama, welcomed the American stranger.

The Isthmian Canal Commission always looked carefully after the religious activities of the people of the Canal Zone. Its provision of places of worship and facilities for getting to them was strictly nonsectarian, and directed solely to giving every sect and every faith opportunity to worship in its own way. Several chaplains were maintained at Government expense, and railroad and wagonette service for carrying people to their places of worship was maintained throughout the years of the American occupation.

The West Indian negroes were provided with churches and with homes for the leaders of their spiritual flocks. Church buildings were erected at every settlement, and in many cases were so constructed that the lower story could be used for a church and the second story for lodge purposes. These buildings were 70 by 36 feet, with lodge rooms 60 by 36 feet.

The women on the Canal Zone were interested in religious work from the beginning of their residence there. An Isthmian Sunday School Association maintained church extension work. When the Women's Federation of Clubs finally disbanded, in April, 1913, it presented its library to this association and its pictures to the Ancon Study Club. There was an art society at Ancon, which did much to foster art work on the Zone during the days of the canal construction. The organization of Camp Fire Girls extended its activities to Panama, and many leading women there contributed both means and time to help the girls on the Isthmus.

The women of the Zone did not fail to enlist

themselves in any movement for good in their communities. A few years since there was a little blind boy on the Isthmus and the Federation of Women's Clubs decided that he ought to have better educational advantages than could be provided at Panama. Therefore, they agreed to finance his going to Boston to enter an institution for the education of the blind. When the Federation disbanded, owing to the gradual departure of members for the States, it did not do so until it had created a committee which was to continue indefinitely in charge of the education of this blind boy.

Many secret societies existed on the Isthmus, the oldest one made up of Americans being the Sojourners Lodge of Free and Accepted Masons, organized in Colon in 1898. There were Odd Fellows' lodges and lodges of Redmen, Modern Woodmen, Knights of Pythias, Elks, Junior Order of American Mechanics, and representative bodies of many other American secret orders. An Isthmian order is that of the Kangaroos, whose motto is: "He is best who does best." This order was organized in 1907 under the laws of Tennessee, and the mother council was organized at Empire the same year. The object of the Kangaroos is to hold mock sessions of court and to extract from them all of the fun and, at the same time, all of the good that they will yield.

The men on the Isthmus, almost completely isolated as they were from American political concerns, never allowed their interest in political affairs at home to become completely atrophied. There was a common saying that the Panamans

were the only people on the Isthmus that could vote, but at times the Americans would at least simulate politics at home with the resulting campaigns and elections. During the presidential campaign of 1912 it was decided to hold a mock election in several of the American settlements. The elections were for national offices and for municipal offices as well. There were a number of parties, and in the national elections there were the usual group of insurgents. progressives, reactionaries, and the like.

There were nominations for dog catchers and town grouches, while the party platforms abounded in all the political claptrap of the ordinary American document of like nature. Cartoons were circulated showing the Panama Railroad to be a monopolistic corporation; flaring handbills proving that the latest town grouch had not acquitted himself properly in office; statistical tables showing that the dog catcher had allowed more dogs to get away from him than he had caught; and all sorts of other campaign tricks and dodges were brought into play, just as though there were real issues at stake and real men to be elected. At Colon the presidential returns showed 33 votes for Taft, 200 for Wilson and 224 for Roosevelt. There were 204 votes in favor of Woman Suffrage, both state and national, and 75 votes against it.

As has been said, when the American first went to Panama the only diversion a man could find was to go to a cheap saloon and meet his friends. It was a condition that was as unsatisfactory to the men themselves as it was to the

moral sentiment of those behind the work, and almost as dangerous to the success of the undertaking as would have been an outbreak of some epidemic disease. This led the commission to urge the erection of clubhouses in several of the more populous settlements, to be conducted under the auspices of the Young Men's Christian Association, but to be operated on a basis that would bring to the people those rational amusements of which they stood so much in need.

From time to time clubhouses of this type were established in seven of the American settlements and the work they did in promoting the contentment and happiness of the people can be appreciated only by those who have witnessed the conditions of living in Canal Zone towns where there were no such clubhouses.

Almost the first effect of the construction of a clubhouse was a heavy falling off in barroom attendance, and simultaneously a decline in the receipts from the sales of liquor. It is estimated that these receipts fell off 75 per cent within a short time after the clubhouses were opened. The men who had been buying beer at 25 cents a bottle, or whiskey at 15 cents a thimbleful, were now frequenting the clubhouses, playing billiards, rolling tenpins, writing letters, reading their home papers, or engaging in other diversions which served to banish homesickness.

When the Y. M. C. A. clubhouses were opened a practical man was put at the head of each. While no one would think of card-playing or dancing at a Y. M. C. A. in the States, both were to be found in the association clubhouses of the

Isthmus. Bowling alleys, billiard rooms, gymnasiums, and many other features for entertainment were established in the clubhouses. Bowling teams were organized; billiard and pool contests were started; gymnastic instruction was given; pleasant reading rooms with easy chairs, cool breezes, and good lights were provided; circulating libraries were established; good soda fountains were put in operation where one could get a glass of soda long enough to quench the deepest thirst; and in general the clubhouses were made the most attractive places in town — places where any man, married or single, might spend his leisure moments with profit and with pleasure.

Every effort was put forth to capitalize the spirit of rivalry in the interest of the men. The result was that in each clubhouse there were continuous contests of one kind or another, which afforded entertainment for those engaged and held the interest of those who were looking on. Then the champions of each clubhouse, whether individuals or teams, were pitted against the stars of other places, and in this way there was always "something doing" around each clubhouse.

In addition to maintaining a supervision over the sports of the Isthmus, the clubhouses provided night schools for those who desired to improve such educational opportunities. These night schools were rather well patronized by the new arrivals on the Isthmus, but there is something in that climate which, after a man has been there for a year, makes him want to rest whenever he is off duty. Going to night school became an intolerable bore by that time, so very

few men kept up their attendance after the first year. The study of Spanish was found to be one exception to this rule, for, besides the satisfaction of being able to talk with native Panamans and the Spaniards, there was the hope of financial reward. Any employee who could pass an examination in Spanish stood a better show of getting promotion in the service. Besides, the man who had grit enough to carry through a course of study on the Isthmus, with its enervating climate, was almost certain to climb the ladder of success wherever he went.

A review of the work of the seven Y. M. C. A. clubhouses for 1912 gives a good idea of what they did during the entire construction period. It required a force of 42 Americans and 64 West Indians to operate these seven clubhouses. Twelve of the Americans were paid out of the funds of the Canal Commission and 30 out of the funds of the Y. M. C. A. Of the negro employees 43 were paid by the Canal Commission and 21 by the Y. M. C. A. The American force for all seven clubhouses consisted of one superintendent, four secretaries, four assistant secretaries, one clerk, ten night clerks, six bowling alley night attendants, six pool room night attendants, and seven barbers. At the end of that year there were 2,100 members of the Y. M. C. A., no less than 58 per cent of all the American employees living in towns having clubhouses being members of the association.

During the year seven companies of players and musicians were engaged to provide amusement at the clubhouses. They gave 85 entertainments

which had a total attendance of 21,000. Local talent and moving pictures provided 406 entertainments with a total attendance of 96,000. Amateur oratorio societies, operatic troupes, minstrel troupes, glee clubs, mixed choruses, vaudeville and black-face sketches were organized during the year through the efforts of the members cooperating with the secretaries. These organizations made the whole circuit of the Isthmus. Weekly moving-picture exhibitions were given and a man was employed who gave his entire attention to them. Carefully chosen films were ordered from the United States, special attention being given to educational features.

Special tournaments in bowling, billiards, and pool were organized and gold, silver, and bronze medals were awarded the winners. Over a hundred thousand bowling games and nearly 300,000 games of pool and billiards were played during the year. Trained physical directors were employed to direct the gymnastic exercises at the clubhouses and there was an attendance of 15,000 at these classes during the year. A pentathlon meet was held at Empire for the purpose of developing all-around athletes. Religious meetings and song services were held at such times as not to interfere with the organized religious work on the Zone, the average attendance at 214 meetings being 50 and the average attendance at Bible and discussion clubs 52. The average enrollment was 65 in the Spanish class. Forty-two thousand books were withdrawn for home reading during the year.

Soft drinks, ice-cream, light lunches, and the

like were served on the cool verandas of the clubhouses, the receipts from these sales amounting to approximately $50,000. Nearly 4,000 calls on hospital patients were made by committees for the visitation of the sick. Boys from 10 to 16 years of age were allowed special privileges in the clubhouses, and the secretaries arranged several outings during the year. The total boys' membership was 146. The disbursements from the funds of the Isthmian Canal Commission amounted to $50,000 and those from clubhouse funds amounted to $114,000. The total receipts for the year amounted to $118,000. The affairs of the clubhouses were in the hands of the advisory committee appointed by the chairman and chief engineer of the Isthmian Canal Commission.

In providing amusements the Canal Commission overlooked no opportunity in the way of furnishing special trains and affording other facilities for encouraging play by the canal workers. Each town had its ball team and its ball park, and there was just as much enthusiasm in watching the standing of the several clubs in the Isthmian League as in the States in watching the performances of the several clubs in the American and National leagues. When there was a championship series to be played there was just as much excitement over it as if it were a post-season contest between the Athletics and the Giants.

It is probable that better amusements will be provided under the permanent régime than were during the construction period. With ships constantly passing through the canal, many opera companies, especially those from Spain and Italy,

will have opportunity to stop for a night or two at Panama, while their ships are coaling or shipping cargo. In Panama City there is a splendid theater built by the Panaman Government largely out of funds derived from payments made by the United States on account of the canal rights.

As the major portion of the permanent force will be quartered at Ancon and Balboa, they will be able to drive to the theater or take the street car. A new street-car system has just been established, and those who can not afford the luxury of carriages will find in it opportunities for taking airings as well as going to the theater. This system runs from the permanent settlement at Balboa through the city of Panama and down over the savannahs towards old Panama. It is the first street-car system ever operated on the Isthmus, and will probably prove much more satisfactory than the little, old, dirty coaches which have afforded the only means of transportation on the Zone.

The building of a number of roads along the canal to facilitate the movement of military forces has made it possible to get a satisfactory use of automobiles. Agencies already have been opened for a number of the lower-priced cars in anticipation that a large number of the canal employees will buy automobiles in order to get the benefit of these good roads. There are few places where automobiling affords more pleasant diversion than at Panama. After the sun goes down the evenings are just cool enough and the breezes just strong enough to make an automobile ride a delightful experience.

There are good opportunities for lovers of hunt-

ing and fishing on the Isthmus. There is wild game in plenty — deer abounding in the entire region contiguous to the canal and alligators being found in all of the principal streams. There are both sea and river fishing, and some tapirs and other wild animals still are left to attract the efforts of the modern huntsman.

The entertainment headquarters on the Canal Zone under the permanent occupation will be the big clubhouse at Balboa, which is being built at a cost of about $50,000. This clubhouse will not only have all of the features of the clubhouses of the construction period, but will be equipped with a large auditorium, with a complete library and with every facility for amusement and entertainment that experience on the Isthmus has called for.

It can not be said that social life on the Isthmus during the period of canal construction was ideal. Its inspiration was to be found in the desire to make the best of a bad situation. Men and women all knew that their stay in Panama was but temporary, none of them looked upon the Canal Zone as home, and all of them counted time in two eras — Before we came to Panama, and When we leave Panama.

Of course there was dining and dancing, and the bridge tables were never idle. But every dinner hostess knew that every guest knew exactly what every dish on the table cost, and she knew that guest knew she knew. The family income was fixed and public. All one had to do was to read the official bulletins.

The same paternalistic commissary that reduced

the cost of living and made housekeeping so easy, also tended with socialistic frankness to bring everybody to a dead level. It was useless to attempt any of the little deceits that make life so interesting at home.

Although the American is a home-loving animal, he managed to get on fairly well in the alien atmosphere of the Tropic jungle. He brought with him his home life, his base ball and his soda fountain. And, considering how such things go in the Tropics, he managed to live a clean life while he was doing a clean piece of work.

CHAPTER XVI

PAST ISTHMIAN PROJECTS

THE digging of an Isthmian Canal was a dream in the minds of many men in Europe and America from the day that Columbus found two continents stretched across his pathway in his endeavor to discover a western route to India. On his last voyage, as he beat down the coast of Central America, here naming one cape "Gracias a Dios" and there another "Nombre de Dios," testifying his thanks to God and his reverence for His name, he touched the Isthmus near the present Atlantic terminus of the Panama Canal. He little dreamed that some day ships 500 times as large as his own would pass through the barrier of mountains which Nature interposed between his ambitions and India.

The idea of a canal through the American Isthmus was in the mind of Charles V of Spain as early as 1520. In that year he ordered surveys to ascertain the practicability of a canal connecting the Atlantic and the Pacific. His son, Philip II did not agree with him about the desirability of a trans-Isthmian waterway, holding that a shipway through the Isthmus would give to other nations easy access to his new possessions, and in time of war might be of greater advantage to his enemies than to himself. He invoked the

Bible to put an end to these propositions to dig a canal across the American Isthmus, calling to mind that the Good Book declared that "what God hath joined together let no man put asunder."

The policy of Philip was continued for about two centuries, although in the reign of his father many efforts had been made in the direction of a ship waterway across the Isthmus. In fact, ships crossed the Isthmus nearly four centuries before the completion of the canal. About 1521 Gil Gonzales was sent to the New World to seek out a strait through the Isthmus. He sailed up and down the Central American coast, entering this river and that, but failing of course to find a natural waterway. Not to be outdone, he decided to take his two caravels to pieces and to transport them across the Isthmus. He carried them on the backs of Indians and mules from the head of navigation on the Chagres River to the ancient city of Panama. There he rebuilt them and set out to sea, but they were lost in a storm. Still determined to make the most of his opportunities, Gonzales built others to take their places and with these made his way up the Pacific coast through the Gulf of Fonseca to Nicaragua, where he discovered Lake Nicaragua. A few years later another explorer made a trip across Lake Nicaragua and down the San Juan River to the Atlantic.

Cortez, the conquistador of Mexico, at one time was ordered to use every resource at his command in a search for the longed-for strait. He did not find it, but he did open up a line of communication across the Isthmus of Tehauntepec, following prac-

tically the same line as was afterwards followed by Eads with his proposed ship railway.

From those days to the time when the United States decided that the canal should be built at Panama and that it should be made a national undertaking, one route after another was proposed. In 1886, immediately after the French failure, the Senate requested the Secretary of the Navy to furnish all available information pertaining to the subject of a canal across the Isthmus, and Admiral Charles H. Davis reported that 19 canal and 7 railway projects had been proposed, the most northerly across the Isthmus of Tehauntepec and the most southerly across the Isthmus of Panama at the Gulf of Darien, 1,400 miles apart. Eight of these projects were located in Nicaragua.

In 1838 the Republic of New Granada, which then had territorial possession of the Isthmus of Panama, granted a concession to a French company to build a canal across the Isthmus. This company claimed to have found a pass through the mountains only 37 feet above sea level. In 1843 the French minister of foreign affairs instructed Napoleon Carella to investigate these claims. That engineer found no such pass and reported the claims to be worthless. He, in turn, advocated a canal along the route followed by the present Panama Canal, with a 3-mile tunnel through Culebra Mountain and with 18 locks on the Atlantic slope and 16 locks on the Pacific slope. He estimated the cost of such a canal at $25,000,000. The first formal surveys of the Panama route were made in 1827 by J. A. Lloyd. He recommended a combination rail and

water route, with a canal on the Atlantic side and a railroad on the Pacific side.

The first serious proposition to build a Nicaragua Canal was made in 1779 when the King of England ordered an investigation into the feasibility of connecting the Nicaraguan lakes with the sea. A year later Capt. Horatio Nelson, destined to become the hero of Trafalgar, headed an expedition from Jamaica to possess the Nicaraguan lakes, which he considered to be the inland Gibraltar of Spanish America, commanding the only water pass between the oceans. His expedition was successful as far as overcoming Spanish opposition was concerned, but a deadlier enemy than the Don decimated his ranks. Of the 200 who set out with Nelson only 10 survived, and Nelson himself narrowly escaped with his life after a long illness.

In 1825 what now constitute the several countries of Central America were embraced in one federation — the Central American Republic. It asked the cooperation of the American people in the construction of a canal through Nicaragua. Henry Clay, then Secretary of State, favored the proposition, and, in 1826, the Federation entered into a contract with Aaron H. Palmer, of New York, for the construction of a canal through Nicaragua capable of accommodating the largest vessels afloat. Palmer was unable to command the necessary capital and the concession lapsed. A few years later an English corporation sent John Bailey to Nicaragua for the purpose of securing a canal concession. He failed to get the concession but was later employed by the Nicaraguan Govern-

ment, which again had become independent, to determine the most feasible location for a canal across Nicaragua.

The United States Government became deeply interested in Isthmian Canal projects during the Forties of the last century. The extension of the national domain to the Pacific coast made the building of an Isthmian Canal a consideration of prime importance to the United States, and made it a dangerous policy to allow any other country to acquire a dominating hand over an Isthmian waterway. The result was that the American Government advised the British Government that it would not tolerate the control of any Isthmian Canal by any foreign power. This later brought about the Clayton-Bulwer treaty, which made neutral the proposed Nicaraguan Canal.

In 1849 Elijah Hise, representing the United States, negotiated a treaty with Nicaragua, by the terms of which that country gave to the United States, or its citizens, exclusive right to construct and operate roads, railways, canals, or any other medium of transportation across its territory between the two oceans. The consideration exacted by Nicaragua was that the United States should guarantee the independence of that country — a consideration that was then paramount because of the effort being made by Great Britain to gobble up the "Mosquito Coast" as far east as the San Juan River. The United States was not ready to give such a guarantee — although a half century later it did give it to the Republic of Panama — and the Hise treaty failed of ratification in the Senate.

A little later Cornelius Vanderbilt became interested in a canal and road across Nicaragua under an exclusive concession running for 85 years. Modifications of this concession permitted the Vanderbilt Company to exercise exclusive navigation rights on the lakes of Nicaragua. As a result the Accessory Transit Company established a transportation line from the Atlantic through the San Juan River and across Lake Nicaragua, thence by stage coach over a 13-mile stretch of road to San Juan del Sur on the Pacific.

In 1852 Col. Orville Childs made a report to President Fillmore upon the results of his surveys for a Nicaraguan Canal; and, if the United States, in 1902, had elected to build the Nicaraguan Canal, the route laid out by Childs would have been followed for all but a few miles of the entire distance. In 1858 a French citizen obtained from Nicaragua and Costa Rica a joint concession for a canal, which contained a provision that the French Government should have the right to keep two warships on Lake Nicaragua as long as the canal was in operation. The United States politely informed Nicaragua and Costa Rica that it would not permit any such agreement — that it would be a menace to the United States as long as the agreement was in force. Upon these representations the concession was canceled.

In 1876 the first Nicaraguan Canal Commission created by the American Congress made a unanimous report in favor of a canal across Nicaragua, after it had investigated all the proposed routes from eastern Mexico to western South America. It asserted that this route possessed,

both for the construction and maintenance of the canal, greater advantages and fewer difficulties from engineering, commercial, and economic points of view than any one of the other routes shown to be practicable by surveys sufficient in detail to enable a judgment to be formed of their respective merits.

When the first French Panama Canal Company began its work all other projects fell by the wayside for the time being, just as all other plans for interoceanic canals were abandoned when the United States undertook the construction of the present canal. After that company failed, however, the Maritime Canal Company of Nicaragua was organized in 1889 by A. G. Menocal, under concessions from the Government of that country and Costa Rica. The Atlantic end of this canal, as proposed by the Maritime Canal Company, was located on the lagoon west of Greytown. The Pacific end was located at Brito, a few miles from San Juan del Sur. This canal company built three-fourths of a mile of canal, constructed a temporary railway and a short telegraph line, but soon thereafter became involved in financial difficulties which led to a suspension of operations. Even to this day the visitor to Nicaragua may see many evidences of the wrecked hopes of that period for whatever town he visits he finds there Americans and Europeans who went to Nicaragua at the time of the opening of the work of building a canal by the Maritime Canal Company. They expected to find a land of opportunity. But, with failure of the canal project, they found themselves in the possession of properties whose value lay only in staying there and operating them.

When the first Isthmian Canal Commission, in 1899, undertook to investigate all of the proposed routes across the connecting link between North and South America, it placed on the Nicaraguan route alone 20 working parties, made up of 159 civil engineers, their assistants, and 455 laborers. The entire work of exploring the Nicaraguan route was done with the greatest care. The depth of the canal, as adopted by the commission, was 35 feet and the minimum width 150 feet. The locks were to be 840 feet long and 84 feet wide, and of these there were to be eight on the Pacific and six on the Atlantic side. This canal was to be 184 miles long. At the Atlantic end there was to be a 46-mile sea-level section and at the Pacific end a 12-mile sea-level section, while the water in the middle 126-mile section was to be 145 feet above the water in the two oceans. It was estimated that it would cost $189,000,000 to build the Nicaraguan Canal.

Although the distance between the Atlantic and Pacific ports of the United States would have been more than 400 miles shorter by the Nicaragua Canal than by the Panama Canal, it would have taken about 24 hours longer to pass through the former than through the latter, so that, as far as length of time from Atlantic to Pacific ports was concerned, the two routes would have been practically on a par. The total amount of material it would have been necessary to excavate at Nicaragua approximates, according to the estimates, 228,000,000 cubic yards. This would have been increased, perhaps, by half, to make a canal large enough to accommodate ships such as

will be accommodated by the present Panama Canal.

The three great trans-Isthmian projects may be said to have been: The Panama Canal, the Nicaraguan Canal, and the James B. Eads ship railway across the Isthmus of Tehauntepec. The latter proposition seems to be the most remarkable, in some ways, of them all. In 1881, James B. Eads, the great engineer who built the Mississippi River bridge at St. Louis, and whose work in jetty construction at the mouths of the Mississippi proved him to be one of the foremost engineers of his day, secured a charter from the Mexican Government conveying to him authority to utilize the Isthmus of Tehauntepec for the construction of a ship railway from the Atlantic to the Pacific. His plan called for a railway 134 miles long, with the highest point over 700 feet above the sea, and designed to carry vessels up to 7,000 tons. He calculated that the entire cost of the railway would not be more than $50,000,000. His plan was to build a railroad with a large number of tracks on which a huge cradle would run. This cradle would be placed under a ship, and the ship braced in the manner of one in dry dock. Heavy coiled springs were to equalize all stresses and to prevent shocks to the vessel. A number of powerful locomotives would be hitched to the cradle and would pull it across the Isthmus. Although the proposition was indorsed by many authorities, it seems to anyone who has crossed the Isthmus of Tehauntepec that it was a most visionary scheme.

If one can imagine a ship railway across the

Allegheny Mountains between Lewiston Junction and Pittsburgh on the Pennsylvania Railroad, or between Washington and Goshen, Va., on the Chesapeake & Ohio Railroad, he will have a very good idea of the difficulties which would be encountered in building such a railway. The present Tehauntepec railroad is 188 miles long. When crossing the Cordilleras there are numerous places on this road where the rear car of the train and the engine are traveling in diametrically opposite directions. The road is well-built, and, as one crosses the backbone of the continent, and beholds the engineering difficulties that were encountered in building an ordinary American railroad, he can not help but marvel at the confidence of a man who would endeavor to build across those mountains a shipway large enough and straight enough to carry a 7,000-ton ship. Yet Captain Eads estimated that his shipway could be constructed in four years at one-half the cost of the Nicaraguan Canal; that vessels could be transported by rail much more quickly than by canal; that in case of accident the railway could be repaired more speedily; and that it could be enlarged to carry heavier ships as business demanded.

He declared that he did not think it would be as difficult to build a ship railway across the Isthmus of Tehauntepec as to build a harbor at the Atlantic entrance of the Nicaraguan Canal. His confidence in his project was such that he proposed to build a short section of the road to prove its practicability before asking the United States to commit itself to the project. Commodore

T. D. Wilson, at that time Chief Constructor of the United States Navy, declared in a letter to Captain Eads that he did not believe the strains upon a ship hauled across the Isthmus, as Eads proposed, would be greater than those to which ocean steamers are constantly exposed. Gen. P. T. G. Beauregard, of Confederate Army fame, declared that a loaded ship would incur less danger in being transported on a smooth and well-built railway than it would encounter in bad weather on the ocean.

A prominent English firm offered to undertake the building and completion of the necessary works for placing ships with their cargo on the railway tracks of the trans-Isthmian line, declaring that they had no hesitation in guaranteeing the lifting of a fully loaded ship of 8,000 or 10,000 tons on a railway car to the level of the railroad in 30 minutes, if the distance to be lifted was not over 50 feet. The death of Captain Eads ended this picturesque project.

A proposition once was made to build a canal across the Isthmus of Tehauntepec. This would have required 30 locks on each side of the Isthmus of 25 feet each, and these locks alone would have cost, on the basis of the locks at Panama, perhaps as much as the whole Panama Canal.

One of the narrowest parts of the Isthmus is that lying between the present Panama Canal route and the South American border. Three routes were proposed in this section, known as the Atrato River route, the Caledonia route, and the San Blas route. It was found that a canal built along any one of these routes would require a

tunnel. The estimated cost of building a tunnel 35 feet deep, 100 feet wide at the bottom, and 117 feet on the waterline, with a height of 115 feet from the water surface, the entire tunnel being lined with concrete 5 feet thick, would approximate $22,500,000 a mile. The cost of building a canal along one of these routes would have been greater than that of building either the Nicaragua Canal or the Panama Canal.

The question of an Isthmian Canal will probably be forever set at rest at no distant date. In an effort to forestall for all time any competition in the canal business across the American Isthmus, negotiations are now under way whereby the United States seeks to acquire the exclusive rights for a canal through Nicaragua, just as it now possesses exclusive rights for a canal through the Republic of Panama. The conclusion of the work at Panama will end the efforts of four centuries to open up a shipway from the Atlantic to the Pacific across the American Isthmus.

CHAPTER XVII

THE FRENCH FAILURE

ONE writes of "the French failure" at Panama with a consciousness that no other word but failure will describe the financial and administrative catastrophe that humbled France on the Isthmus, but at the same time with the knowledge that failure is no fit word to apply to the engineering accomplishments of the French era.

The French fiasco ruined thousands of thrifty French families who invested their all in the shares of the canal company because they had faith in de Lesseps, faith in France, and faith in the ability of the canal to pay handsome returns whatever might be its cost. The failure itself was due primarily to the fact that de Lesseps was not an engineer, but a promoter. The stock sales, the bond lottery, the pomp and circumstance of high finance, were more to him than exact surveys or frank discussion of actual engineering problems.

From the first, de Lesseps ignored the engineers. The Panama proposition was undertaken in spite of their advice, and at every turn he hampered them by impossible demands, and by making grave decisions with a debonair turn of the hand.

The next factor in the failure was corruption.

Extravagance such as never was known wasted the sous and francs that came from the thrifty homes of that beautiful France. Corruption, graft, waste — there was never such a carnival of bad business.

And then the French had to fight the diseases of the tropic jungles without being armed with that knowledge that gave the Americans the victory over yellow fever and malaria. It was hardly to be expected that the French ever would discover the necessity of substituting the Y. M. C. A. and the soda fountain for the dance hall and the vintner's shop, if the canal were to be completed.

But the engineers did their work well, as far as they were permitted to go. It may have cost too much — but it was well done. The failure of the French Panama Canal project was due, therefore, to moral as much as to material reasons.

Long years after the French had retired defeated from the field, one could behold a thousand mute but eloquent reminders of their failure to duplicate their triumph at Suez. From one side of the Isthmus to the other stretched an almost unbroken train of gloomy specters of the disappointed hopes of the French people.

Here a half-mile string of engines and cars; there a long row of steam cranes; at this place a mass of nondescript machinery; and at that place a big dredge left high and dry on the banks of the mighty Chagres at its flood stage, all spoke to the visitor of the French defeat. Exposed to the ravages of 20 tropical summers, decay ran riot, and but for the scenes of life and industry being enacted by the Americans, one might have felt him-

self stalking amid the tombs of thousands of dead hopes.

Almost as much money was raised by the French for their failure as was appropriated by the Americans for their success. From the gilded palace and from the peasant's humble cottage came the stream of gold with which it was hoped to lay low the barrier that divided the Atlantic and the Pacific. At first the French estimated that in seven or eight years they could dig a 29-foot sea-level canal for $114,000,000. After eight years they calculated that it would cost $351,000,000 to make it a 15-foot lock canal and require 20 years to build it.

Never was money spent so recklessly. For a time it flowed in faster than it could be paid out — even by the Panama Canal Company. When the company started it asked for $60,000,000. Double that amount was offered. The seeming inexhaustibility of the funds led to unparalleled extravagance; of the some $260,000,000 raised only a little more than a third was spent in actual engineering work. Someone has said that a third of the money was spent on the canal, a third was wasted, and a third was stolen.

The director general at the expense of the stockholders built himself a house costing $100,000. His summer home at La Boca cost $150,000. It came to be known as "Dingler's Folly," for Dingler lost his wife and children of yellow fever and never was able to live in his sumptuous summer home. He drew $50,000 a year salary, and $50 a day for each day he traveled a mile over the line in his splendid $42,000 Pullman. The hospitals at

Ancon and Colon cost $7,000,000, and the office buildings over $5,000,000. Where a $50,000 building was needed, a $100,000 building was erected, and the canal stockholders were charged $200,000 for it.

Supplies were bought almost wholly without reference to actual needs. Ten thousand snow shovels were brought to the Isthmus where no snow ever has fallen. Some 15,000 torchlights were carried there to be used in the great celebration upon the completion of the canal. Steamboats, dredges, launches, and whatnot were brought to the Isthmus, knocked down, and taken into the interior to await the opening of the waterway. The stationery bill of the canal company with one firm alone amounted to $180,000 a year. When the Americans took possession they found among other things a ton of rusty and useless pen points, not one of which had ever been used.

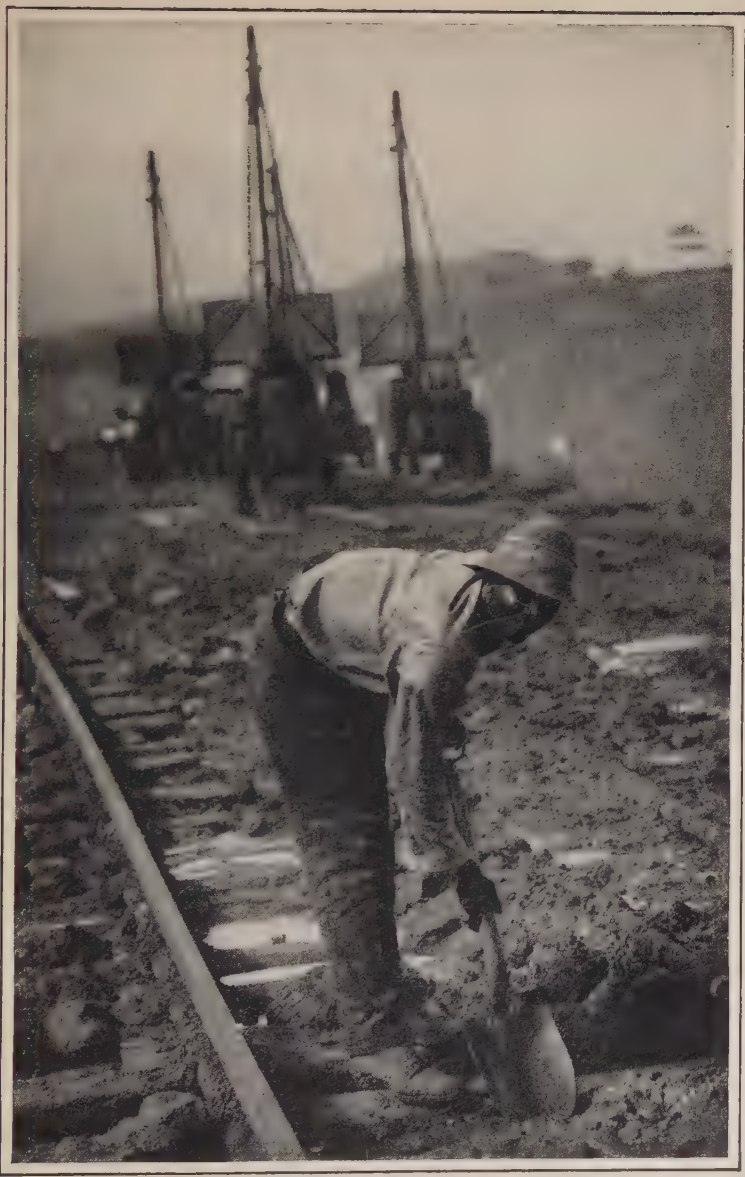
Two years' service entitled employees to five months' leave of absence and traveling expenses both ways. There was no adequate system of accounting and any employee could have his requisition for household articles honored almost as often as he liked. In a multitude of cases this laxity was taken advantage of and quite a business was carried on secretly in buying and selling furniture belonging to the company. One official built a bath house costing $40,000. A son of de Lesseps became a silent partner of nearly every large contractor on the Isthmus, getting a large "rake-off" from every contract let.

Near the summit of the Great Divide the Americans who took possession in 1904 found a small

iron steamer. It is said to have been the purpose of the canal promoters to put this little steamer on a small pond in Culebra Cut, and by the aid of a skillful photographer to get a picture showing navigation across the Isthmus. This steamer was hauled by the Americans to Panama, where during the years of the American construction work it did service in carrying the sick to the sanitarium at Taboga.

The different uses to which this steamer was put during the French and American régimes illustrates the different aims of the Americans and the French in connection with the Panama Canal. There was little concern about the health of the canal workers under the French, in spite of great liberality in the construction of hospitals. The construction work was let out to contractors, who were charged a dollar a day by the French Company for maintaining the sick members of their force in the hospital. Of course, the contractors were not over anxious to put their employees into the hospitals. The result was that the death rate at Panama reached almost unprecedented proportions.

This was aided to a very large degree by the manner of living obtaining there at that time. In 1887 Lieutenant Rogers, of the United States Navy, inspected the canal work and reported that the laborers were paid every Saturday, that they spent Sunday in drinking and Monday in recuperating, returning to work on Tuesday. A prominent English writer declared after a visit to Panama that in all the world there was not, perhaps, concentrated in any single spot so much



THE MAN OF BRAWN

FERDINAND DE LESSEPS

AN OLD FRENCH EXCAVATOR NEAR TABERNILLA

PHILIPPE BUNAU-VARILLA

swindling and villainy, so much vile disease, and such a hideous mass of moral and physical abominations.

Add to these things the fact that no one then knew of the responsibility of the stegomyia mosquito for the existence of yellow fever, nor that the anopheles mosquito was the disseminator of malaria, and it is little wonder that the French failed. The hospitals, instead of aiding in the elimination of yellow fever, became its greatest allies. The bedposts were set in cups of water, and here the yellow-fever mosquitoes could breed uninterruptedly and carry infection to every patient. Wards were shut up tight at night to keep out the "terrible miasma," and the nurses went to their own quarters. When morning came there were among those thus left alone always some ready for the tomb.

The history of the French attempt to construct the Panama Canal begins, in reality, with the Suez Canal. In 1854 Ferdinand de Lesseps, a Frenchman connected with the diplomatic service, saw an opportunity to revive the plans for a Suez Canal that had been urged by Napoleon in 1798. His friend, Said Pasha, had just succeeded to the khediviate of Egypt, and his proposals were warmly received. The building of the canal, which presented no serious engineering problems, was begun in 1859 and completed 10 years later. There was a sordid side to its story, too; but as the losses were borne chiefly by the Egyptians, Europe ignored them and looked only to the great success of the canal itself.

As a result, de Lesseps became a national hero

in France, and when it became known that he contemplated piercing another isthmus, the whole country rose to his support. In 1875, six years after the Suez Canal had been opened, and as soon as France had recovered her breath from the shock of the war with Prussia, a company was organized by de Lesseps to procure a concession for the building of a Panama Canal.

Already the world, as well as France, had come to regard de Lesseps as an engineer, rather than as a promoter of stock companies, and in this lay the germ of the disaster that was to overtake the whole scheme.

In 1876, Lucien Napoleon Bonaparte Wyse, a lieutenant of engineers in the French Army, was sent to Panama to determine the most feasible route and to conclude negotiations for the construction of a canal there. He made a perfunctory survey, commencing at Panama and extending only two-thirds of the way to the Atlantic coast; nevertheless, he calculated the cost in detail and claimed that his estimates might be depended upon to come within 10 per cent of the actual figures. However weak in engineering he may have been, he was strong in international negotiations, returning to France with a concession which gave him the right to form a company to build the canal, and which gave to that company all the rights it needed, subject only to the prior rights of the Panama Railroad Company under its concession. The concession was to run for 99 years, beginning from the date when the collection of tolls on transit and navigation should begin. The promoters were allowed 2 years to

form the company and 12 years to build the canal. The Government of Colombia was entitled to a share in the gross income of the canal after the seventy-fifth year from its opening. Four-fifths of this was to be paid to the National Government and one-fifth to the State of Panama. The canal company was to guarantee that these annual payments should on no account be less than $250,000.

When Wyse returned to Paris he got de Lesseps to head the project. The hero of Suez summoned an international commission of individuals and engineers, known as the International Scientific Congress, which met in Paris, May 15, 1879. There were 135 delegates in attendance, most of whom were Frenchmen, although nearly every European nation was represented. The United States had 11 representatives at this congress. After two weeks' conference the decision was reached that a sea-level canal should be constructed from Colon to Panama. Only 42 of the 135 men who met were engineers, and it has been stated that those who knew most about the subject found their opinions least in demand. M. de Lesseps dominated the conference. Several members who were radically opposed to its conclusions, rather than declare their difference from the opinions of a man of such great distinction and high reputation as de Lesseps enjoyed at that time, absented themselves when the final vote was taken.

After it was determined to build a sea-level canal, the canal concession owned by Wyse and his associates was transferred to the Compagnie

Universelle du Canal Interoceanique (The Universal Interoceanic Canal Company) of which de Lesseps was given control. The canal company was capitalized at $60,000,000. The preliminary budget of expenses amounted to $9,000,000, of which $2,000,000 went to Wyse and his associates for the concession. The organizers were entitled to certain cash payments and 15 per cent of the net profits.

The canal company soon found it necessary to acquire a controlling interest in the Panama Railroad. That corporation insisted on charging regular rates on all canal business. In addition, it possessed such prior rights as made the Wyse concession worthless except there be agreement on all matters between the railroad company and the canal company. The result was that the canal company bought the railroad, and its rights, for the sum of about $18,000,000.

The first visit of de Lesseps to the Isthmus was made in the early weeks of 1880. He arrived on the 30th day of December, 1879, and was met by a delegation appointed by the Government, and one nominated by the State Assembly. There was the usual reception, with its attendant champagne and conviviality, and a fine display of fireworks at night. The next day, with a chart before him, de Lesseps promptly decided where the breakwater to protect the mouth of the canal from the "northers" sweeping into Limon Bay should be located. He declared that in the construction of the canal there were only two great difficulties — the Chagres River and Culebra Cut. The first he proposed to overcome by sending its waters

to the Pacific Ocean by another route — a project which it has since been estimated would have cost almost as much as building the canal. The second difficulty he thought would disappear with the use of explosives of sufficient force to remove vast quantities of material with each discharge. There was a great hurrah, and an international celebration during de Lesseps' stay. The flags of all nations were prominently displayed, with the single exception of that of the United States.

Count de Lesseps was over 70 years old when he first visited the Isthmus, though he was still active and vigorous. Mr. Tracy Robinson described him as "a small man, French in detail, with winning manners and a magnetic presence. He would conclude almost every statement with, 'The Canal will be made,' just as a famous Roman always exclaimed, 'Delende est Carthago.' He was accompanied to the Isthmus by his wife and three of his seven children. Being a fine horseman, he delighted in mounting the wildest steeds that Panama could furnish. Riding over the rough country in which the canal was being located all day long, he would dance all night like a boy and be ready for the next day's work 'as fresh as a daisy.'"

On New Year's Day, 1880, de Lesseps formally inaugurated the work of building the canal. A large party of ladies and gentlemen visited the mouth of the Rio Grande where the first shovelful of sod was to be turned. An address was made by Count de Lesseps, and a benediction upon the enterprise was bestowed by the Bishop of Panama. Champagne flowed like water, and it is said that

the speechmaking continued so long that the party did not have time to go ashore to turn the sod, so it was brought on board and Miss Fernanda de Lesseps there made the initial stroke in the digging of the big waterway.

Some days later the work at Culebra Cut was inaugurated. Tracy Robinson thus described the scene: "The blessing had been pronounced by the Bishop of Panama and the champagne, duly iced, was waiting to quell the swelter of the tropical sun as soon as the explosion went off. There the crowd stood breathless, ears stopped, eyes blinking, half in terror lest this artificial earthquake might involve general destruction. But there was no explosion! It would not go! Then a humorous sense of relief stole upon the crowd. With one accord everybody exclaimed, 'Good Gracious!' and hurried away for fear that after all the dynamite should see fit to explode. That was Fiasco No. 1."

After de Lesseps left the Isthmus he toured the United States where he was everywhere welcomed although he did not find a market in this country for his stock.

The scientific congress estimated the cost of building the canal, whose construction de Lesseps had inaugurated, at $214,000,000. M. de Lesseps himself later arbitrarily cut this estimate to $131,000,000, and announced that he believed that vessels would be able to go from ocean to ocean after the expenditure of $120,000,000. He declared that if the committee had decided to build a lock canal, he would have put on his hat and gone home, since he believed it would be

much more expensive to build a lock canal with twin chambers than to build a sea-level waterway. There were those who declared that six years was the utmost limit that would be required for building the big ditch. Others asserted with confidence that it could be done in four years.

During the first three years the company devoted its time to getting ready for the real work. By 1885 the profligate use of the money subscribed by the French people brought the funds of the canal company to a very low ebb. M. de Lesseps asked for permission to establish a lottery, by which he hoped to provide additional funds for carrying on the work. The French Government held up the matter and finally sent an eminent engineer to investigate. This engineer, Armand Rosseau, reported that the completion of a sea-level canal was not possible with the means in sight, and recommended a lock canal, plans for which he submitted. The summit level of this canal was to be 160 feet, reached by a series of seven or eight locks. After this plan was adopted, to which de Lesseps reluctantly consented, lottery bonds of a face value of $160,000,000 were issued which were to bear 4 per cent interest. But the people failed to subscribe.

At the outset of the work de Lesseps established a bulletin for the dissemination of information concerning the canal; during the entire period of his connection with the project this bulletin was filled with the most exaggerated reports, and the most reckless mis-statements in favor of a successful prosecution of the work. By 1888 the confidence of the French people in

de Lesseps waned. Unable to raise more money, and now popularly dubbed the "Great Undertaker," he found himself in such straits that he saw the French Government take over the wrecked organization by appointing a receiver with the power to dispose of its assets. This proved a terrible blow to the people on the Isthmus. Untold hardships befell the small army of laborers and clerks. The Government of Jamaica repatriated over 6,000 negroes. The Chilean Government granted 40,000 free passages to Chile, open to all classes except negroes and Chinese, and for several months every mail steamer south took away from 600 to 800 stranded people from the canal region. Where good times and the utmost plenty had prevailed for years, the Isthmus was now face to face with a period of want and privation, its glory departed and its hope almost gone.

The receiver of the Panama Canal Company assisted in the organization of another company known as the New Panama Canal Company. With a working capital of $13,000,000, it excavated more than 12,000,000 cubic yards of material. In 1890 it found itself in danger of losing everything by reason of the expiration of its concession. The services of Lieutenant Wyse were again brought into play, and he secured a 10-year extension of the concession. In 1893 another concession was granted, with the provision that work should be begun on a permanent basis by October 31, 1894, and that the canal should be completed by October 31, 1904. Toward the end of the nineties, it was manifest that the concession would expire before the work could be

finished, so, in April, 1900, another extension was arranged, which stipulated that the canal should be completed by October 31, 1910. The New Panama Canal Company, as a matter of fact, had no other aim in view than to keep the concession alive in the hope that it could be sold to the United States.

With all of their profligacy, however, the French left to their American successors a valuable heritage. What they did was done with the utmost thoroughness. The machinery which they bequeathed to the Americans was of immense value. There was enough of this to cover a 500-acre farm 3 feet deep, with enough more to build a 6-foot fence around it all. The French equipment was of the best. Dredges and locomotives that stood in the jungle for 20 years were rebuilt by the Americans at less than 10 per cent of their first cost, and did service during the entire period of construction.

Although the New Panama Canal Company at one time asked $150,000,000 for its assets, it finally accepted $40,000,000. An appraisement made by American engineers a few years ago showed that the actual worth of the property acquired, aside from the franchise itself, amounted to about $42,000,000.

Count de Lesseps lived to a great age. His last years were saddened and embittered by the volumes of denunciation that were written and spoken against him. Certain it is that no man ever went further than he to maintain confidence in a project that was destined to fail, and yet his partisans declared that his sin was the sin of over-

enthusiasm and not of dishonest purpose. Under the torrents of abuse that fell upon his head his mind weakened, and, fortunately, in his last days he realized little of the immeasurable injustice his misplaced zeal and overenthusiasm had wrought against the people of France.

CHAPTER XVIII

CHOOSING THE PANAMA ROUTE

PROUD as Americans now are of the success of their venture at Panama, in the beginning there was by no means a general agreement that the United States would succeed where France had failed. Indeed, the French disaster had much influence in strengthening the position of those who favored building the American canal through Nicaragua.

Prior to the year 1900 little thought was given by the American people to any project for building an Isthmian Canal anywhere else than through Nicaragua. It is true that in 1897 the New Panama Canal Company became active in its efforts to induce the United States to adopt the Panama route, but these activities made little impression upon public sentiment before the outbreak of the Spanish American War. During that war interest in the question of an Isthmian Canal waned in America, and immediately after it the sympathy which France had given to Spain made it advisable for the Canal Company to postpone its propaganda.

In his annual message to Congress in December, 1898, President McKinley recommended the building of the Nicaragua Canal. Two days later Senator John T. Morgan, of Alabama, made

a vigorous speech in the Senate, in which he charged that the transcontinental railroads of the United States were making efforts to defeat the canal project. This charge was made repeatedly thereafter, and it was asserted that the railroads espoused the cause of the Panama Canal upon the ground of choosing the lesser of two evils, judged from their standpoint. Prior to 1900 both Republican and Democratic parties had repeatedly favored the construction of the Nicaragua Canal in their national platforms, and both branches of Congress had voted for the canal at different times.

In the early part of 1899 the Senate passed a bill authorizing the construction of a Nicaraguan Canal. The House refused to act on the bill, and, at the instance of Senator Morgan, the Senate attached a rider to the rivers and harbors bill, appropriating $10,000,000 to begin the building of the canal. This passed the Senate by a vote of 54 to 3. The amendment was defeated in the House and the matter went to conference. If the House conferees stood pat in their opposition to the Senate amendment, the whole rivers and harbors bill would be defeated unless the Senate conferees yielded. The House conferees remained unshaken in their opposition to the Nicaragua Canal provision, and were willing to wreck the whole rivers and harbors bill rather than to authorize the beginning of operations in the construction of the Nicaragua Canal under the plan framed by the Senate.

According to Philippe Bunau-Varilla, the real secret of the defeat of the Nicaragua Canal proj-

ect at this juncture lay in a dispute between the House and Senate as to the manner of building the canal. The Senate wanted to do it by the reorganization of the Maritime Canal Company, with the majority of its board of directors appointed by the President, using that corporation as the agent of the Government for constructing and operating the canal. Representative William P. Hepburn, of Iowa, at that time Chairman of the Committee on Interstate and Foreign Commerce, contended that such a plan proposed that the United States should masquerade as a corporation, instead of doing the work in its own proper person, as it was in every sense capable of doing. He asked for what purpose the Government should thus convert itself into a corporation, making of itself an artificial person and taking a position of equality with a citizen? He further pointed out that as a corporation the Government might be sued in its own courts, and fined for contempt by its own judicial servants.

A compromise was adopted in the form of an appropriation of $1,000,000 to defray the expenses of an investigation into all of the various routes for an Isthmian Canal. This investigation was to have reference particularly to the relative merits of the Nicaragua and Panama routes, together with an estimate of the cost of constructing each. The investigators were to ascertain what rights, privileges, and franchises were held, and what work had been done in the construction of the proposed canals. They were also to ascertain the cost of acquiring the inter-

ests of any organizations holding franchises on these routes. The President was directed to employ engineers of the United States Army and engineers from civil life, together with such other persons as were necessary to carry out the purposes of the investigation. A few months later he appointed the first Isthmian Canal Commission, consisting of Rear Admiral John G. Walker, Senator Samuel Pasco, Alfred Noble, George S. Morison, Peter C. Hains, William H. Burr, O. H. Ernst, Louis M. Haupt, and Emory R. Johnson.

Thus it came about that the House and Senate, divided only upon the issue of the proper method of building the Nicaragua Canal, reopened the whole question, and gave to the Panama Canal advocates a chance to make a fight in favor of that route. The advocates of the Nicaragua Canal were not satisfied, however, to await the discoveries of the commission Congress had created. On May 2, 1900, before the commission made its report, the House voted 234 to 36 in favor of the Nicaragua route. The bill went to the Senate, where it was favorably reported by the Committee on Interoceanic Canals. Senator Morgan made a formal motion for the immediate consideration of the measure, but it was lost by a vote of 28 to 21. He then had the 2nd day of December following fixed as the date for again taking up the matter. His committee made a report roundly scoring the representatives of the New Panama Canal Company for their activities in favor of the Panama route.

In December, 1900, Secretary Hay signed pro-

tocols with the ministers of Nicaragua and Costa Rica, by which those Governments undertook to negotiate treaties as soon as the President of the United States should be authorized by Congress to acquire the Nicaragua route. In the following February, Senator Morgan offered an amendment to the sundry civil appropriation bill authorizing the President to go ahead with the construction of the canal. When Theodore Roosevelt became President in September, 1901, he recommended the building of the Nicaragua Canal in his official statement of policy.

In the meantime the Isthmian Canal Commission had been repeatedly attempting to get the New Panama Canal Company to state for what sum it would sell its holdings to the United States. The figures finally presented placed a value of $109,000,000 upon the property. After this, the Isthmian Canal Commission unanimously recommended the adoption of the Nicaragua route. Congress again took up the matter, upon a bill introduced by Representative Hepburn, making an appropriation of $180,000,000 for the construction of the canal. This measure was favorably reported by the House Committee on Interstate and Foreign Commerce, and also secured the approval of the Senate Committee on Interoceanic Canals.

A few days later a formal convention was signed in Nicaragua by the minister of foreign affairs and the American minister, looking to the construction of the canal through Nicaraguan territory. A week later the Senate ratified the Hay-Pauncefote treaty with Great Britain. On

January 7 the House of Representatives again took up the matter and, in spite of the fact that the New Panama Canal Company had decided to accept $40,000,000 for its property, this offer was rejected by the House of Representatives, which passed the bill authorizing the construction of the Nicaragua Canal by the overwhelming vote of 309 to 2.

After the rejection of the offer of the New Panama Canal Company by the House, President Roosevelt again called the members of the Isthmian Canal Commission together, and asked them to make a supplementary report in view of the offer in question. On a motion of Commissioner Morison the commission decided that, in consideration of the change of conditions brought about by the offer of the company to sell its property for $40,000,000, the Panama route was preferable. It has been stated that Professor Haupt, Senator Pasco, and two other members of the commission were reluctant to abandon the Nicaragua project; that President Roosevelt had made it quite clear to Admiral Walker that he expected the commission to accept the Panama Canal Company's offer; that Commissioners Noble and Pasco had given in, but that Professor Haupt stood out; and that he was induced to sign the report only after Admiral Walker had called him out of the committee room and pleaded with him to do so, stating that the President demanded a unanimous report. Professor Haupt afterwards publicly admitted the truth of this story in a signed article in a magazine.

About this time the Senate Committee on In-

teroceanic Canals appointed a subcommittee of six members to study and report on the legal questions involved in the transfer of the New Panama Canal Company's title, and a majority reported that the company's title was defective and that it had no power to transfer. It was finally decided that the Senate Committee on Interoceanic Canals should make no report until all of the members of the Isthmian Canal Commission had appeared before it and testified. This delay permitted negotiations between the United States, the New Panama Canal Company, and the Republic of Colombia looking to a settlement of the question of title.

The New Panama Canal Company was now thoroughly in earnest in its desire to dispose of its holdings to the United States, but the Republic of Colombia, desiring to drive a good bargain, held aloof. The hope of the situation as far as the Panama route was concerned, lay in Senator Marcus A. Hanna, of Ohio, who had come to espouse the Panama route. He declared he would not recommend the acceptance of the proposals of the New Panama Canal Company unless a satisfactory treaty could be obtained, and unless the shareholders of the company would ratify the action of the board of directors in making the offer. A meeting of the shareholders was called in February, 1902, at which the Republic of Colombia, holding a million dollars' worth of stock in the company, was represented by a Government delegate. He served formal notice on the company that it was forbidden, on pain of forfeiture of its concession, to sell its rights to

the United States before that action was approved by the Colombian Government, there being a clause in the concession providing that in the event of such a sale to any foreign Government all rights, titles, and property should revert to Colombia.

When the Colombian Government took up the matter it showed a disposition to grasp the lion's share. Its minister was instructed to exact no less than $20,000,000 from the New Panama Canal Company for Colombia's permission to transfer its concessions. This demand was based on the following reasons: First, because Colombia's consent was essential; second, because Colombia would lose its expectation of acquiring the Panama Railroad at the expiration of its concession — a road that was then valued at $18,000,000; third, because under the proposed contract with the United States, Colombia was to renounce its share in the prospective earnings of the canal, which might amount to a million dollars a year.

Another proposition was drawn by the Colombian minister, proposing to lease a zone across the Isthmus of the United States for a period of 200 years at an annual rental of $600,000. At another time the Colombian minister declared that, inasmuch as the New Panama Canal Company had taken advantage of the straitened circumstances of the Colombian Government to obtain a six-year extension of its concession, which was really what the canal company was about to sell for $40,000,000, he thought Colombia ought to require the New Panama Canal Company to pay $3,000,000 of the $40,000,000, for

what the company gained by the extension of its concession.

On January 30, 1902, Senator John C. Spooner, of Wisconsin, introduced a bill in the Senate, authorizing the President of the United States to build an Isthmian Canal at Panama, if the necessary rights could be obtained. If those rights could not be obtained the President was required to build the canal on the Nicaraguan route. The Spooner bill provided the machinery for the construction of the canal, created the Isthmian Canal Commission, and authorized the expenditures necessary for undertaking the project. Some six weeks later the Senate Committee on Interoceanic Canals rejected the Spooner bill and presented a favorable report on the Hepburn bill, which authorized the Nicaragua Canal.

The final struggle in the Senate lasted from June 4 to June 19, 1902. Senators Morgan and Harris led the fight for the Hepburn bill, while Senators Hanna and Spooner championed the Spooner measure. The fight resulted in the passage of the Spooner bill by a vote of 32 to 24. The disagreeing votes of the two Houses were then sent to conference, and the House finally receded from its position in favor of the Nicaragua route, and the Spooner bill became a law. The situation as it now stood was that the Panama route was chosen on the conditions that the title of the company be proved and that a satisfactory treaty with Colombia be negotiated; with the alternative of the adoption of the Nicaragua route in default of one or the other of these conditions.

Whatever may have been his motives — in

the light of events which have followed it would seem unjust to question them — Senator Hanna was undoubtedly responsible for the revolution in Congress and in public sentiment which resulted in the selection of the Panama route. M. Banau-Varilla declares that he met Myron T. Herrick in Paris, converted him, and through him met Senator Hanna, whom he also convinced. In Crowley's "Life and Work of Marcus Alonzo Hanna," it is declared that a series of interviews between M. Banau-Varilla and Senator Hanna had much to do with Mr. Hanna's decision to make a fight in behalf of Panama. It was claimed by William Nelson Cromwell, in his suit for fees against the New Panama Canal Company, that he was responsible for converting Senator Hanna to the Panama project, and it was asserted, also, that he furnished the data from which Senator Hanna made his speech which converted the Senate, and the House, and the country, and led to the adoption of the Panama route.

At this juncture Providence seemed to lend support to the Panama route, for one of the many volcanoes in Nicaragua became active and did considerable damage. Occurrences since then have borne out the wisdom of avoiding the Nicaragua route. A few years ago the city of Cartago, only about a hundred miles distant from the site of the works that would have been installed to control the waters of Lake Nicaragua, was entirely destroyed by an earthquake.

With the Spooner bill enacted into law, the next proposition which confronted the United States Government was that of reaching an under-

standing with Colombia, which would permit the building of the canal at Panama. That country was reminded on every hand and in divers ways that unless an acceptable treaty were forthcoming the President of the United States would be forced to adopt the Nicaragua route. But, notwithstanding these reminders, Colombia still moved slowly in the matter. After being repeatedly urged to come to terms, and after one Colombian minister to the United States had been recalled and another resigned, the Hay-Herran treaty finally was negotiated.

Before Colombia reached the stage, however, where it would agree to enter into negotiations with the United States, it had been reminded by its minister in Washington that it was dangerous not to enter into an agreement. He had declared that if Colombia should refuse to hear the American proposal that a new treaty be entered into, the United States would, in retaliation, denounce the treaty of 1846, and thereafter view with complacency any events which might take place in Panama inimical to Colombia's interests. He had reported further that the United States would, at the first interruption of the railroad service, occupy at once Colombia's territory on the Isthmus and embrace whatever tendency there might be toward separation, in the hope of bringing about the independence of Panama. This, he had concluded, would be a catastrophe of far greater consequence to Colombia than any damage the Republic might suffer by the ratification of a treaty with the United States permitting the building of the canal.

His views in the matter were strengthened by a suggestion of Senator Shelby M. Cullom, of Illinois, that if Colombia should continue to refuse to allow the United States to build the canal, which the United States claimed was its right to do under the treaty of 1846, the American Government might invoke a sort of universal right of eminent domain, take the Isthmian territory, and pay Colombia its value in accordance with an appraisement by experts.

About this time President Roosevelt wrote a letter to his friend, Dr. Albert D. Shaw, of the Review of Reviews, in which he said that he had been appealed to for aid and encouragement to a revolution at Panama, but that as much as he would like to see such a revolution, he could not lend any encouragement to it. The Republic of Colombia was repeatedly reminded by Secretary Hay that if it did not act promptly the President would take up negotiations with Nicaragua and proceed to construct the canal there. Under these conditions Colombia finally agreed to negotiate the Hay-Herran treaty, which was afterwards rejected by the Colombian Congress.

It has been asserted that President Roosevelt took the view all along that under the treaty of 1846, Colombia had no right to prevent the United States from building the canal, and that, in spite of the provision of the Spooner Act requiring him to proceed with the construction of the Nicaragua Canal in the event of the failure of negotiations at Panama, he was determined to exhaust every possible effort before giving up the Panama route.

CHAPTER XIX

CONTROVERSY WITH COLOMBIA

SELDOM in the history of international relations has a controversy afforded more grounds for honest difference of opinion than the issue between the United States and Colombia, growing out of the revolution and formation of the new Republic of Panama. The most careful and unprejudiced study still may leave room for doubt as to the real merits of the case.

In 1903, after the United States had decided to build an Isthmian Canal, preferably at Panama, but if that route were not available at Nicaragua, a treaty was entered into at Washington between the Governments of the United States and Colombia. This Hay-Herran treaty, as it was known, in simple terms provided that the United States would pay Colombia $10,000,000 in cash, and $250,000 a year after the completion of the canal, if the Republic of Colombia would agree to permit the New Panama Canal Company to sell its concession and property to the United States. This treaty, according to President Roosevelt, was entered into under negotiations initiated by the Republic of Colombia. The treaty was ratified by the United States Senate, and was then sent to Colombia for its ratification.

At the time the treaty was pending in the Colombian Congress, the President of the Republic was a man who had been elected Vice President, but who had kidnapped the President with a troop of cavalry and shut him up in an insanitary dungeon where he soon died. The Vice President thus became the head of the Government. Anyone who knows conditions in such countries as Colombia, understands that a President has no use for a Congress except to have it register his own will. The President of Colombia at first advocated the negotiation of the treaty, but he repudiated it after it had been signed, and then declared that if the Colombian minister to Washington were to return to Colombia he would be hanged for signing it. The result of this change of front was that the treaty was rejected by the Colombian Congress. All sorts of stories were put abroad in Colombia to arouse opposition to it. One was that the United States would make $180,000,000 out of the canal deal the minute the treaty was ratified by Colombia. It was claimed by the Colombian Government that the constitutional prohibition of the cession of territory to a foreign state would have to be changed by amending the Constitution before the Congress could legally ratify the treaty.

How little the President of Colombia respected the laws of his country is shown by a dispatch received by the Government at Washington after the secession of Panama, in which it was promised that if the United States would assist Colombia in putting down the Panama revolution, the next Colombian Congress would ratify the rejected

treaty. Or, failing that, the President would declare martial law, by virtue of vested constitutional authority when public order is disturbed, and ratify the canal treaty by presidential decree. If the Washington Government did not like such a proposal, the President of Colombia would call an extra session of Congress and immediately ratify the treaty.

The real cause of the failure of the Hay-Herran treaty is not difficult to discover. The concession of the New Panama Canal Company under one of its renewals expired October 31, 1893. It was then extended for a year, and, in 1894, was extended again for a period of 10 years. Still another extension was granted, which carried the date of expiration to October 31, 1910. This last extension was granted by the President without the consent of the Colombian Congress. In 1903, when the Hay-Herran treaty was pending, the validity of this last extension was denied, and the assertion made that on October 31, 1904, all of the rights and property of the New Panama Canal Company would revert to the Colombian Government.

The United States had agreed to pay to the New Panama Canal Company $40,000,000 for its concession and property. According to Representative Henry T. Rainey, of Illinois, who for years led the attack in the United States Congress on the acts of President Roosevelt in connection with the Panaman revolution, the purpose of Colombia in defeating the treaty was to wait until the expiration of the concession, when all of the property of the canal company would revert to

Colombia, and it could then sell it to the United States and get the $40,000,000, or any other amount it could persuade the United States to pay.

Of course, the New Panama Canal Company did not look upon such an arrangement with any degree of complacency. It felt that it was a deliberate scheme upon the part of the Colombian Government to mulct it out of its property and its rights. As a result it was naturally ready to lend aid and encouragement to any movement which would circumvent this purpose of Colombia. It found conditions in Panama just what it might have wished.

The people of Panama felt that they had the same sort of grievance against Colombia that the people of the American colonies felt they had against England in 1776. The governors of the province were, with few exceptions, sent there from Bogota, and were entirely out of sympathy with the people of Panama. The taxes collected at Panama were carried to Bogota, as a rule, and the voice that the people of the Isthmus had in the Government of Colombia was negligible. Furthermore, they felt that they were entitled to their sovereignty.

After the countries of tropical America had thrown off the yoke of Spain, Panama found itself too small to stand alone, and accepted an invitation from Bogota to put itself under the Government there with the understanding that it was to retain its sovereignty. It soon found that this agreement was not respected at Bogota. Almost immediately there were attempted revolts and, in

1840, the Isthmus again won complete independence. The Confederation of New Granada promised that the people of the Isthmus should have better treatment, and it was set forth in the constitution of New Granada that Panama was a sovereign state, and that it had full right to withdraw and set up an independent government at any time. In 1885 a new constitution was proclaimed by Colombia, which had succeeded New Granada, and this constitution deprived Panama of all its rights as a sovereign state, and made it a province under the control of the Federal Government at Bogota. Upon these grounds Panama claimed that she was a sovereign state temporarily under the duress of a superior government. After the defeat of the Hay-Herran treaty the inhabitants of Panama knew that if the treaty failed and no other steps were taken, the Nicaraguan route would be followed and Panama would become almost a forgotten region instead of a land of great opportunity.

The consequence was that the Panamans lent willing ears to the suggestion of the representatives of the New Panama Canal Company that they should undertake a revolution to be financed by the canal company. Two representatives of the New Panama Canal Company working along independent lines were trying to bring about the revolution. One of these was Philippe Bunau-Varilla, formerly chief engineer of the Old Panama Canal Company, but who had become estranged from the New Panama Canal Company. The other was William Nelson Cromwell, for years general counsel of the Panama Railroad Company,

and who, in his suit against the New Panama Canal Company for an $800,000 fee, claimed to have engineered and directed the revolution. M. Bunau-Varilla had some stock in the canal company and a great deal of pride in seeing realized the undertaking to which he had committed the best years of his life.

Coming to New York on another mission, he met Dr. Amador, who was one of the Panamans desiring the independence of his country. According to the testimony of M. Bunau-Varilla, which is borne out by documentary evidence, he and Dr. Amador worked out the plan for the revolution. He declares that the documents were drawn in the Waldorf-Astoria Hotel and as far as they were written in Spanish, they were copied letter by letter by an English stenographer who knew no Spanish, in order that there might be no possibility of the secret leaking out. He declares that the whole project of the revolution as it was carried out was conceived by him in cooperation with Dr. Amador, and that William Nelson Cromwell, the other factor in the situation, knew nothing about what was going on. He also asserts that William Nelson Cromwell had promised to introduce Dr. Amador to Secretary of State John Hay, but that later Dr. Herran, the representative of Colombia, found out what was going on and wrote a letter of warning to Mr. Cromwell as to the consequences which would come to the Panama Railroad, of which Mr. Cromwell was the representative, if that organization should give aid or comfort to the projected Panama revolution. Thereupon, according to M. Bunau-

Varilla, Mr. Cromwell turned his back upon Dr. Amador, although it has been claimed by some that this was only a ruse on the part of Mr. Cromwell to shield himself and his company from responsibility. About this time M. Bunau-Varilla borrowed $100,000 in France to finance the revolution, pending the recognition of the new Republic by the United States. Other money was forthcoming later.

The revolution itself, which took place in November, 1903, was bloodless. The world knows that President Roosevelt forbade the Colombian troops to move across the Isthmus, while at the same time he would not allow the revolutionists to make any move. A similar situation had arisen in a former revolution in 1902. At that time the Colombian troops were disarmed, and three days later insurgent troops were prevented by United States marines from using the railroad and were actually compelled to leave a train which they had seized and entered. The principle was enunciated and maintained that no troops under arms should be transported on the railroad, no matter to which party they belonged. That was because to permit such transportation would be to make the railroad an adjunct to the side using it, and to subject it to attack by the other party. In this way, if the Colombian troops used it, the insurgents would have attacked, and the United States would either have been forced to permit such an attack, which might suspend traffic on the transit, or to prevent it with force, which would make this country an ally of Colombia against the insurgents. On the other hand, if the insur-

gents were permitted to use the railroad, Colombia would attack it, and in that case the United States would have to help repel the attack and thus would become the ally of the insurgents. It was, therefore, held that the only way to make the road absolutely neutral was to allow neither party to use it.

This was the doctrine under which President Roosevelt proceeded in 1903. Of course, the world knows that this was tantamount to preventing Colombia from reconquering the Isthmus, if that were possible. It is claimed by some that if President Roosevelt had allowed the insurgents to use the railroad in 1902, Colombia would have been defeated in that revolution.

At the time of the revolution it is said that the Colombian garrison which espoused the cause of the Panamans was bribed to do so; that their commander two days afterwards was paid $12,500 for his services, and that he is to this day drawing a pension of $2,400 a year. It is also charged that some of the troops who could not be bribed were sent into the interior to repel an imaginary invasion from Nicaragua. It is asserted that when the governor of the State of Panama telegraphed the Colombian Government that Nicaragua was invading Panama, the Bogota authorities sent additional troops to the Isthmus to help fight Nicaragua, and that this accounted for the arrival of the gunboats from Cartagena on the eve of the revolution.

At the time of the *coup d'etat*, the United States was living under a treaty made with Colombia in 1846, guaranteeing the sovereignty of that coun-

try over the Isthmus in return for the recognition of the rights of the United States, under the Monroe doctrine, in connection with the building of a canal. Under this treaty it was mutually agreed that the United States should keep the Isthmian transit free and open at all times. It was contended by President Roosevelt that he was only carrying out this provision when he refused to allow the revolutionists and the Federal troops to fight along the line of the Panama Railroad, although this was almost the only ground on the Isthmus on which military operations could be prosecuted. He admitted the justice of the contention of the Colombian Government that the United States undertook to guarantee the sovereignty of Colombia over the Isthmus so far as any alien power was concerned, but denied that it was ever intended that the United States should be called upon to guarantee it against the people of the Isthmus themselves.

Once the revolution was started three courses were left open to the United States: One was to force the Panamans back under Colombian rule; the second was to let the two sides fight to a finish; the third was to recognize the independence of the Republic of Panama and forbid Colombia to land troops on the Isthmus. President Roosevelt took the last course. A breezy Western congressman remarked in defense of that course: "When that jack rabbit jumped I am glad we didn't have a bowlegged man for President!" The result of the revolution, and the recognition of the independence of the Republic of Panama, was that Colombia, which had tried to

grasp everything and to get possession of the assets of the New Panama Canal Company, now found itself without anything.

Colombia ever since has contended that the United States was under a solemn obligation to protect the Colombian sovereignty over the Isthmus — an obligation that has been assumed in return for valuable considerations — and that it had been despoiled of the Isthmus of Panama under the very treaty that had guaranteed its permanent control of that Isthmus. It further asserted that President Roosevelt had been a party to the revolution for the purpose of circumventing the stand of the Republic of Colombia. It made a long plea against the action of the United States and urged that in the event the two countries could not come to any agreement, the pending questions should be submitted to The Hague for adjudication. Secretary Hay at one time proposed that a popular election should be held on the Isthmus to determine whether the people there preferred allegiance to the Republic of Panama or to the Republic of Colombia, but Colombia would not agree to that. Secretary Hay rejected the plea of Colombia for arbitration, upon the ground that the questions that Colombia proposed to submit affected the honor of the United States and that these matters were not arbitrable.

After Elihu Root became Secretary of State, he declared that the real gravamen of the Colombian complaint was the espousal of the cause of Panama by the people of the United States. He said that no arbitration could deal with the real rights and wrongs of the parties concerned, unless it were to

THE PAY CAR AT CULEBRA

EDWARD J. WILLIAMS

UNCLE SAM'S LAUNDRY AT CRISTOBAL

pass upon the question of whether the cause thus espoused was just — whether the people of Panama were exercising their just rights in maintaining their right of independence of Colombian rule. "We assert and maintain the affirmative upon that question," he declared. "We assert that the ancient State of Panama was independent in its origin, and by nature and history a separate political community; that it was federated with the other States of Colombia upon terms that preserved and continued its sovereignty, and that it never surrendered that sovereignty and was subjugated by force in 1885." Mr. Root further asserted that the United States was not "willing to permit any arbitrator to determine the political policy of the United States in following its sense of right and justice by espousing the cause of the Government of Panama against the Government of Colombia."

When Mr. Taft became President it was his desire to adjust our controversy with Colombia. His Secretary of State, Philander C. Knox, just before leaving office, declared that he had spared no efforts in seeking to restore American-Colombian relations to a footing of complete friendly feeling, but that these efforts had been rebuffed by the Colombian Government. He declared that it was undeniable that Colombia had suffered by its failure to reap a share of the benefits of the canal, and that the Government of the United States was entirely willing to take this consideration into account, and endeavor to accommodate the conflicting interests of the three parties by making a just compensation in money. In pursuance of

this idea three treaties were negotiated: One between the United States and the Republic of Colombia, one between the United States and the Republic of Panama, and one between the Governments of Colombia and Panama, all three being interdependent, to stand or to fall together. These treaties were negotiated at the instance of Colombia and were framed with every desire to accommodate their terms to the just expectations of that country. They were accepted by the Colombian Cabinet, but were not acted upon by the Colombian Congress.

In the Knox treaty negotiated with Colombia in 1910 that country proposed to agree to a popular election upon the separation of Panama and to abide by the result. The United States offered to sign an additional agreement to pay to Colombia $10,000,000 for a permanent option for the construction of an interoceanic canal through Colombian territory, and for the perpetual lease of the Islands of St. Andrews and Old Providence, if Colombia would ratify the treaties with the United States and Panama. This proposition was refused. It was then proposed that in addition to the $10,000,000 the United States would be willing to conclude with Colombia a convention submitting to arbitration the question of the ownership of the reversionary rights in the Panama Railroad — rights which the Colombian Government asserts that it possesses. In addition to this the United States offered its good offices to secure the settlement of the Panama-Colombia boundary dispute.

All of these propositions being rejected, the

Republic of Colombia was asked if it would be willing to accept $10,000,000 outright, in satisfaction of its claims against the United States. This was also refused.

Acting upon his own authority, the American minister then inquired if Colombia would accept $25,000,000, the good offices of the United States in its boundary controversy with Panama, the arbitration of the question of the reversionary rights in the Panama Railroad, and the gift of preferential rights in the use of the canal — all these in satisfaction of its claims. The Colombian Government replied that it would not do this and that it did not care to negotiate any further with the Taft administration, preferring to deal with the incoming Wilson administration.

CHAPTER XX

RELATIONS WITH PANAMA

WHEN the people of the Isthmus of Panama revolted against the Government of Colombia, they fully realized that almost their only hope of maintaining an independent government was to secure the building of the Panama Canal by the United States. Therefore, they were in a mood to ratify a treaty which would meet every condition demanded by the Government of the United States.

The treaty, negotiated and ratified in 1904, gave to the United States every right it could have desired or which it could have possessed had it taken over the whole Isthmus itself. It was negotiated by John Hay, Secretary of State, representing the United States, and Philippe Bunau-Varilla, representing the Government of Panama. As the latter was a stockholder in the New French Canal Company, whose assets could be realized upon only through the success of the treaty negotiations, it naturally followed that he would put nothing in the way of the desires of the United States.

The treaty gave to the United States most unusual rights. For instance, in no other country on earth does one nation possess ultimate jurisdiction over the capital of another nation; yet

this is what the United States possesses at Panama. The first consideration of the treaty was the establishment of the Canal Zone. This gave to the United States a territory 5 miles beyond the center line of the canal on either side, and 3 miles beyond its deep water ends, with the exception of the cities of Colon and Panama, to hold in perpetuity with all rights, powers, and authority that the United States would possess if it were sovereign, and to the entire exclusion of the exercise of any sovereign rights, powers, or authority by the Republic of Panama.

Further than this, it gave to the United States the same rights with respect to any land, or land under water, outside of the Canal Zone necessary and convenient for the canal itself, or any auxiliary canals or other works required in its operations.

Further yet, the Republic granted in perpetuity a canal monopoly throughout its entire territory, and also monopolies of railroad and other means of communication between the two oceans.

Under the terms of the treaty the cities of Panama and Colon are required to comply in perpetuity with all sanitary ordinances, whether curative or preventive, which the United States may promulgate. The Republic of Panama also agrees that if it can not enforce these ordinances, the United States become vested with the power to enforce them. The same is true with reference to the maintenance of order. The Republic of Panama agrees to maintain order, but gives to the United States not only the right to step in with American forces and restore it, but also to determine when such action is necessary.

The treaty between the two countries further provides that the United States has the right to acquire by condemnation any property it may need for canal purposes in the cities of Panama and Colon. The Republic of Panama also grants to the United States all rights it has or may acquire to the property of the New Panama Canal Company and of the Panama Railroad, except such lands as lie outside of the Canal Zone and the cities of Panama and Colon, not needed for the purposes of building the canal. The Republic guarantees to the United States every title as absolute and free from any present or reversionary interest or claim. It will be seen from all this that the United States did not overlook any opportunity to make sure that it had all of the powers necessary to build a canal.

It is also agreed by the Panama Government that no dues of any kind ever shall be collected by it from vessels passing through or using the canal, or from vessels belonging to the United States Government. All employees of the canal are exempted from taxation, whether living inside or outside the Zone. The Republic grants to the United States the use of all its rivers, streams, lakes, and other bodies of water for purposes of navigation, water supply, and other needs of the canal. It also agrees to sell or lease to the United States any of its lands on either coast for use for naval bases or coaling stations.

The Republic of Panama further agrees that the United States shall have the right to import commodities for the use of the Canal Commission and its employees, free of charge, and that it

shall have the right to bring laborers of any nationality into the Canal Zone.

In return for all of these concessions the United States gives to the Republic of Panama many valuable considerations. Most vital of all, it guarantees the independence of the Republic. This means that the Republic of Panama is today practically the possessor of an army and a navy as large as the United States can put into the field and upon the seas. The only aggressor that Panama need fear is her benefactor.

The second consideration involved the payment of $10,000,000 cash to the Republic, and a perpetual annual payment of a quarter of a million dollars beginning with the year 1913. The ten-million-dollar cash payment gave the impoverished new-born government a chance to get on its feet, and from this time forward the Panaman Government can look to the United States for the major portion of its necessary revenues.

Under the terms of the treaty the United States undertakes to give free passage to any warships belonging to the Republic of Panama when going through the canal, and also agrees that the canal shall be neutral. It also agrees to provide free transportation over the Panama Railroad for persons in the service of the Government of Panama, and for the munitions of war of the Republic. It also allows the Republic of Panama to transmit over its telegraph and telephone lines its message at rates not higher than those charged United States officials for their private messages.

Another stipulation of the treaty provides that it shall not invalidate the titles and rights of pri-

vate landholders and owners of private property, nor of the right of way over public roads of the Zone unless they conflict with the rights of the United States, when the latter shall be regarded as superior. No part of the work of building or operating the canal, however, at any time may be impeded by any claims, whether public or private. A commission is provided, whose duty it shall be to pass upon the claims of those whose land or properties are taken from them for the purpose of the construction or operation of the canal.

In carrying out the terms of the treaty the first step taken by the Americans was to "clean up" the cities of Panama and Colon. Remarkable changes were wrought by the establishment of water and sewerage systems, and by street improvements. For several years preceding the acquisition of the Canal Zone, and the sanitization of the cities of Panama and Colon, the late W. I. Buchanan was the United States minister to Colombia. He was transferred to another South American capital and afterwards came back to the United States by way of Panama. Former Senator J. C. S. Blackburn was then governor of the Canal Zone or, more strictly speaking, the head of the Department of Civil Administration. As he and Minister Buchanan drove through the streets of Panama and surveyed the changes that had taken place, Mr. Buchanan declared to Governor Blackburn that if an angel from heaven had appeared to him and said that such a transformation in the city of Panama could be made in so few years he scarcely could have believed it.

When he was there the main streets of the city

were nothing but unbroken chains of mud puddles in which, during the wet season, carriages sank almost to the axles. When he returned he found those same streets well paved with vitrified brick, measuring up to the best standards of American street work. Where formerly peddlers hawked water from disease-scattering springs, there were hydrants throughout the town and wholesome water on tap in almost every house. Where there had been absolutely no attempt to solve the problems of sewage disposal, where the masses of people lived amid indescribable filth, absolutely oblivious to its stenches and its dangers, now there was a sewerage system fully up to the best standard of American municipal engineering.

When one considers that the Republic of Panama is made up largely of the cities of Panama and Colon, with a large area of almost wholly undeveloped territory, it will be seen that this service was rendered to practically all the people of the Republic.

The relations which have existed between the Republic of Panama and the United States have not always proved wholly satisfactory to the Panamans. Like all other tropical Americans, the Panamans profess great admiration for a republican form of government, but the party in power seldom has relished the idea of a full and free accounting of its stewardship at the polls. When the time came for the first national election, the party in power sought to insure its return by the use of tropical-American methods; that is, by a wholesale intimidation of the opposition supporters. When the registration books were opened

the administration was unwilling to register the supporters of the opposition. The government forces always were relied upon to back up the registrars. This situation was resented by the opposition and the indications were that the usual civil war, the tropical American substitute for an election, was about to follow.

At this juncture Governor Blackburn called the Panaman authorities together and notified them that the United States did not care a continental which side won the election, but that it was very deeply interested in maintaining conditions of peace and amity on the Isthmus — conditions which could not prevail except there be a fair election. He reminded them of the right of the United States to maintain order in their two principal cities, and of the blood and treasure the United States had invested in Panama, all of which would be placed in jeopardy by any civil conflict. He therefore declared it the intention of the United States to see that there was a fair election.

Election commissioners were consequently appointed, and they saw to it that the voters were fairly registered, allowed to vote, and to have their votes counted. The result was that for the first time in Central American history there was a fair election and for the first time a real change of administration without a resort to arms. So successful was this plan that in the election of 1912 both sides agreed again to call in the United States to umpire their battle of the ballots, and once again the "outs" won over the "ins."

The French Canal Company has some very

unpleasant experiences with the Republic of Colombia when it, as a private corporation, undertook to build the canal. It was at the mercy of the Government and the Government seldom showed mercy. For instance, a Colombian owned 30 acres of swamp land which was needed for the construction of the canal. It was worth $10 an acre; he demanded $10,000. The canal company took the matter to the courts of the Republic and instituted condemnation proceedings. Here the owner admitted that the land was not intrinsically worth more than $10 an acre, but claimed that he had as much right to demand $300,000 for the tract as if it were located in the very heart of Paris; that in every case it was what the land could be used for that determined its value. The court shared his view and nothing was left for the canal company to do but to pay the $300,000.

Shortly after the Americans took charge, the Central and South American Telegraph Company wanted to land the new "all American" cable on the Canal Zone. They applied to the United States for permission which was granted. The Panamans fought against it under every possible pretext, their desire being to have their consent regarded as essential, so that they could get a good fee for the concession, but the United States notified the Republic of Panama that it had no interest whatever in requiring compensation, and so the cable was laid.

While there has been substantial agreement between the two countries, it has been difficult to prevent some conditions which are contrary to American ideas of morality. For instance, while

the Canal Commission was strongly opposed to having a lottery on the Canal Zone, one is maintained just across the line in the city of Panama. The Panama lottery and the Bishop of Panama share the same house. One has to pass the lottery to see the bishop and, mayhap, a half dozen old women ticket sellers will try to intercept him before he reaches the church dignitary.

This lottery is a veritable gold mine to those who own it. Each ordinary drawing brings in $10,000 — $1 for each ticket issued. The grand prize takes $3,000 of this, the next 9 prizes calling for a total of $900, the next 90 for a total of $450 and the remaining prizes for $2,070. Thus, $6,420 in prizes is paid out of the total of $10,000 received. Out of the remainder, 5 per cent goes to the ticket sellers and 5 per cent to the Panaman Government. Once a month the drawing is made for a grand prize of $7,500. Most of the money which the lottery people make is contributed by workers on the canal. Only 64 per cent of the money received from the sale of tickets is won back by the ticket buyer at each drawing. The net profits approximate a hundred thousand dollars a year.

On the whole, however, the relations entered into between the two Republics in 1904 have been such as to leave no serious ground for complaint. They have permitted the satisfactory construction of the canal, and they will permit its satisfactory operation. With the United States as the ultimate judge of every question vital to American interests, little is left to be desired. The fact is that the canal has been built

with less friction and fewer difficulties with the Republic of Panama than could reasonably have been hoped for at the outset. This has been due principally to the fact that the Americans responsible for the success of the work have approached the Panaman situation with tact where tact was needed and with firmness where firmness was essential.

CHAPTER XXI

THE CANAL ZONE GOVERNMENT

THE Canal Zone is a strip of territory ten miles wide, its irregular lines following the course of the canal, which is its axis. Over this zone the United States, under its treaty with Panama, exercises jurisdiction "as if it were sovereign." The American Government was unwilling to undertake the great and expensive work of constructing the canal without having this guaranty to protect it from possible harassment at the hands of the Panaman authorities.

One of the first tasks that confronted the United States authorities when they entered upon the work of building the canal was that of providing a civil government for this territory named by law the Canal Zone. Postal facilities had to be provided; a police system had to be established; customs offices were required; fire protection was necessary; a court system was needed; a school system was demanded; and, in short, a sort of territorial government had to be put in operation before the work of building the canal could go forward satisfactorily.

This government was established in 1904 under the direction of Major General George W. Davis, the first governor of the Canal Zone. From time to time it was extended and improved. More

than half of this was appropriated out of the Treasury of the United States, and the remainder collected in the operations of the government. In addition to directing the government of the Zone, the head of the department of civil administration was the titular representative of the Canal Commission in all matters in which the commission and the Republic of Panama had a mutual interest. However, in practice, the Panaman Government looked directly to the chairman and chief engineer on all important matters.

One of the earliest and most important subjects requiring their cooperation was that of sanitation in the cities of Panama and Colon. The United States agreed to advance money for building sewer and water systems, and for street improvements, in the two principal cities of the Republic, on condition that the Republic of Panama and the two cities would reimburse the United States Treasury through the water rents. The street improvements were to be paid for in 10 years, and the sewer and water systems in 50 years; in the meantime the United States was to be allowed 2 per cent interest on the money advanced. This amortization of the Republic's debt for these improvements has been going steadily forward.

In laying out the government of the Canal Zone it was thought wise to adhere as closely to Spanish laws and customs as was expedient under the new conditions. In view of this consideration the methods of taxation on the Canal Zone were allowed to remain largely the same as under the old Spanish laws of Colombia. Likewise the

Spanish system of judicial procedure was adhered to during the early years of the construction period. It was not, indeed, until 1908 that the right of trial by jury was established in the Canal Zone. At that time former Senator J. C. S. Blackburn, of Kentucky, was at the head of the department of civil administration, and he regarded it as repugnant to American ideas of justice to deny to Americans on the Isthmus the right to be tried for felonious offenses by juries of their peers. Upon his representations President Roosevelt issued an executive order extending the right of trial by jury to the Canal Zone, and that order was effective after 1908.

With the early opening of the canal it became advisable for Congress to determine the future policy of the United States toward the Canal Zone, and to lay out a system of government there which would meet the needs of the future. It was determined that the Canal Zone should be used for the operation of the canal, rather than for a habitation for such settlers as might choose to go there. Hence the provision was made that the President of the United States should have the right to determine how many settlements there should be on the Canal Zone and how many people should be permitted to live there.

It will be the policy of the United States to discourage general settlement and to maintain only such towns as are necessary for the operation of the big waterway, granting only revocable leases to any outsiders when it is deemed advisable to allow them to occupy land within the Zone. There will be only five settlements in the Zone, if

present plans are carried out: One at Cristobal, one at Gatun, one at Pedro Miguel, one at Corozal, and the settlement at Ancon and Balboa at the Pacific terminus of the canal. The total number of people who will reside in these settlements will probably not exeed 10,000, a material reduction from the 62,000 living on the Zone in 1912. Those who are still there, but who will not be needed in the permanent organization, will be repatriated at the expense of the United States Government. In 1912 there were approximately 31,000 British subjects on the Zone, practically all of them negroes from the British West Indian islands and British Guiana. The great majority of these will be carried back to their homes, as will all of the 4,300 Spaniards who desire to return. There were nearly 12,000 Americans on the Zone at that time, and perhaps two-thirds of them will leave before 1915. There were nearly 8,000 Panamans on the Zone and most of them will go to the cities of Panama and Colon, or upon the Government lands owned by the Panama Republic outside of the Zone.

The work of clearing the Zone of its population was begun early in 1913. A joint land commission was appointed to adjudicate the claims of those Panamans who were living within the Zone on lands that were needed for the operation of the canal. This commission consisted, under the treaty existing between the two countries, of two Americans and two Panamans. In their work they first took up the claims of the poorer classes who had nothing but a thatched hut and a small patch of ground. The commission visited the

various parts of the Zone and fixed the value of such holdings. The people were given free transportation over the Panama Railroad, and usually were allowed from $50 to $100 for their homes. They preferred to move in colonies, so the Republic of Panama laid out small towns away from the Canal Zone for them. These natives, usually almost full-blooded Indians, were treated as kindly and as considerately as conditions would allow. They were willing to "fold their tents" like the Arabs, and leave their homes behind as they went out to conquer new ones in the jungles where the needs of a gigantic waterway could not encroach upon them.

The claims for lands which have to be taken from individuals by the United States will aggregate a half million dollars. As the Panaman Government allows homesteading on Government lands at a cost of about a dollar an acre, and as there are tens of thousands of acres of better land outside of the Canal Zone than inside, the policy of the United States in freeing this strip from native population will not work any great injury to the people.

During the construction period the laws under which the people of the Zone lived were made in three different ways. Of course, Congress as the legislative assembly was always supreme. But under the laws passed by it, the President of the United States was empowered to issue executive orders covering points not touched by congressional legislation, and under his instructions the Secretary of War could promulgate certain orders. In addition to this, the Canal Commis-

sion had a right to serve as a sort of local legislature. During the year 1912 sixteen executive orders pertaining to the Canal Zone were signed by the President and the Secretary of War, while five ordinances were promulgated by the Isthmian Canal Commission during the same period.

The court system under the construction-period government consisted of district courts, circuit courts, and a supreme court. There were five district judges and three circuit judges; and the circuit judges sitting together constituted the supreme court, from whose decisions there was no appeal. Under the permanent law there will be a magistrate's court in each town, which will have exclusive, original jurisdiction in all civil cases involving not more than $300, and of all criminal cases where the punishment does not exceed a fine of a hundred dollars or 30 days in jail, or both. Its jurisdiction will include all violations of police regulations and ordinances, and all actions involving possession or title to personal property or the forcible entry and detainer of real estate. These magistrates and the constables under them will serve for terms of four years. There will be a district court which will sit at the two terminal towns with the usual court officers. The circuit court of appeals of the fifth circuit of the United States will be the court to which appeals from the district court will be carried.

The postal service of the Canal Zone is practically identical with that of the United States. The revenues collected from the sale of stamps and postal cards amounted to $87,550 in 1912. Nearly a quarter of a million money orders were

issued during that year, representing a total of approximately $5,000,000. A postal savings bank system is also maintained, a counterpart of the one in the United States.

All mail matter sent from the Canal Zone bears Panaman stamps countermarked by the Canal Zone government. When the United States established the postal system at Panama, American postage was used. The Panamans were very much dissatisfied with such a procedure, however, since it deprived them of a large share of their postal revenue. Their postal rates to the United States were those of the universal postal union — 5 cents per ounce or fraction thereof on all first-class mail matter. The rate from the Canal Zone was only 2 cents. The result was that the citizens of Panama and Colon would not patronize their own post offices, but carried their mail across the line to the post offices at Ancon and Cristobal where they could mail their letters at the 2-cent rate. The Panaman Government protested against this, and it was agreed by the Americans that in the future all mail matter should carry Panaman postage stamps. These are furnished to the Canal Zone government at 40 per cent of their face value. In this way the share of the Republic of Panama in the postal receipts of 1912 amounted to nearly $33,000.

President Roosevelt selected one of his "rough riders," George R. Shanton, to establish the police force on the Zone. This police force was selected generally from men who had seen service in the United States Army and had made good records there. In 1912 the force consisted of 117 first-

class white policemen, 116 colored policemen, 20 corporals, 8 sergeants, 7 lieutenants, and 2 inspectors, besides a chief of police and an assistant chief of police. During that year 7,055 arrests were made, 70 per cent of which resulted in convictions. Police stations were maintained at all settlements along the line. A penitentiary was located at Culebra where approximately 140 convicts were confined. The penitentiary had to be removed owing to slides at Culebra Cut, and the men were put to work on the roads of the Canal Zone. They were kept in well-guarded stockades at night.

When Judge Henry A. Gudger was made a member of the judicial system of the Canal Zone he believed that it would be the scene of unusual lawlessness; he thought it would be a dumping ground for lawless people from all parts of the world. He therefore believed in strong repressive measures, and his earlier sentences were made heavy with that end in view. He found later, however, that the opposite was true. Under the system of quartering the canal help there was comparatively little mixing of the races. The negroes lived to themselves, the Spaniards to themselves, and the Americans to themselves; therefore, racial friction was largely overcome. The lawless found the Canal Zone a desirable place to shun. Judge Gudger soon discovered that severe measures were unnecessary, and in recommending pardons frequently stated that he had imposed sentences heavier than necessary to carry out the repressive policies he had in mind.

A well-organized, paid fire department was maintained from the beginning and it was supplemented by volunteer companies in many places. In a number of towns fire engines of the latest automobile type were installed. Out of 300 fire alarms in 1912, nearly 200 were for fires in Government property valued at one and three-quarters million dollars, while the total loss was only $5,000.

The school system of the Canal Zone was laid out along the same lines that characterized all other activities for the welfare of the people who were engaged in building the canal. It was founded by Charles E. Magoon when he was governor of the Zone, and in 1912 had 75 teachers and officials, with an enrollment of 2,105, of whom nearly 1,200 were white. The standard required of the teachers was maintained at a high point. Of the 48 white teachers employed in 1912, 13 held degrees from colleges and universities, 19 held diplomas from standard normal schools, and 12 others had enjoyed at least two years of normal teaching. The white children on the Zone were given free transportation to and from the schools. Those who had to go on the railroad to reach their schools were given free passes. Those who attended the schools in their own neighborhood were gathered up in wagons and transported to school.

The system of roads for the parts of the Canal Zone adjacent to the canal itself was built mainly by convict labor at comparatively little cost. They have been useful to the natives in getting their few products to market, and during the

years to come will be available as military roads for use in the defense of the Zone. These roads are built according to the best American standards and are almost the only real roads in the entire Republic. The Panaman Government has extended one road from the Zone line to old Panama, and for a few miles into the interior, but aside from this national road activities have been few indeed.

The American road from Panama to the Zone boundary, leading toward old Panama, over the savannahs, is the pleasure highway of the Republic. It is practically the only road in the Republic where one drives for pleasure, and here every automobile in Panama City is pressed into service during the late afternoon and the evening. The elite of the capital city own summer homes along this road. These homes are by no means as elaborate as the summer homes along the Hudson, but the fact that they were seated amidst veritable gardens of flowers gives them an air of beauty and restfulness attractive even to the most blase traveler.

The water-supply system of the Canal Zone consists of a number of reservoirs on the watersheds of the Isthmus where no human habitations are allowed, and where trespassing is forbidden. The waters are examined for bacteria and other properties once each month, and a report thereon is made to the proper officials. Twice each month a physical examination of each reservoir, and the land from which it receives its water, is made by inspectors who report all conditions to the sanitary and other authorities.

If there is any sign of contamination, steps to overcome the trouble are taken immediately.

Where the reservoirs fill up to the spillway the waste water is not allowed to go over the top, but is drawn out from the bottom in order that the under layers of water may be the ones wasted. Water drawn out for domestic purposes is taken from the top wherever possible. The water has a somewhat unpleasant taste to people newly arrived upon the Isthmus, and in some cases serves to disturb the digestive tract, but to the people who become accustomed to it the unpleasant flavor, due to the presence of decayed vegetation, is forgotten, and the workers on the Canal Zone frequently declare they miss the Panama water when they go back to the States.

The permanent Government of the Canal Zone will be, in the main, merely a miniature of the government during the construction period. The law providing for the operation of the canal makes this Government entirely subsidiary to the main purpose for which the canal was built. It provides that when war is in prospect the President may appoint a military officer to take charge of the Canal Zone, and to conduct its affairs as they might be conducted were the Zone nothing more than a military reservation. The Government will have its headquarters at the Pacific end of the canal where Balboa, the principal permanent town on the Isthmus, will be located. This little American city will be Government-built and Government-owned, and it will be the smallest of all the world's capitals.

Under the new Government all old laws, not

SMOKE FROM HEATED ROCKS IN CULEBRA CUT

TOM M. COOKE

THE POST OFFICE, ANCON

specifically repealed, or contrary to the new ones, will be continued in force. All executive orders issued by the President, and all orders and ordinances promulgated by the Canal Commission, during the construction period, not inconsistent with the act creating a permanent form of government, are made laws of the Canal Zone to continue as such until specifically repealed by act of Congress.

CHAPTER XXII

CONGRESS AND THE CANAL

WHILE the Congress of the United States ever has been charged with a lack of appreciation of the needs of the executive branch of the Government, spending money foolishly here and being niggardly with its appropriations there, the history of the legislation under which the Panama Canal was undertaken and completed shows that American lawmakers backed up the canal diggers in every necessary way.

One may read in all the hearings that were conducted, both on the Isthmus and in Washington, a desire on the part of the congressional committees having to do with the canal matters, to promote the work, and to enable those directly concerned in its execution to carry out their plans without hindrance.

It is probable that no project ever carried to completion under the aegis of the United States Government was studied more carefully by the legislators than the Panama Canal. There was a standing invitation from the Isthmian Canal Commission to members of the Senate and House of Representatives to visit the Isthmus, collectively or individually, for the purpose of acquainting themselves with the character of the work and its needs. This invitation was accepted by a large

percentage of the members of the House and Senate who served during the construction period. When a member of either branch of Congress visited the Isthmus and saw there the character of the work being done, and the spirit of the men behind it, he never failed to return an enthusiastic supporter of the work, ready by vote and voice to contribute his share to the legislation needed.

When the final Isthmian Canal Commission came into power a policy of absolute candor with Congress was adopted. When the annual estimates for appropriations were submitted, they came to Congress with the understanding that they represented exactly what was needed, no more and no less. Instead of recommending from 10 to 25 per cent more than they hoped to get, upon the assumption that Congress would scale down the appropriations — a policy long followed in many of the bureaus of the Government — the canal officials asked Congress to understand from the beginning that the figures they submitted had been pared down to the bone. The result was a happy one. Congress learned to depend upon the figures and to make its appropriations accordingly; consequently, the work was never handicapped by appropriations deficient in one branch and overabundant in another.

Congress for several years made its appropriations for building the canal under the assumption that it was to cost about $145,000,000, exclusive of government, sanitation, purchase price, and payments to the Republic of Panama. It was not until 1908 that a straightforward, definite effort was made to fix the ultimate cost. Ex-

perience showed clearly that all hands had hopelessly underestimated both the total amount of work to be done and the unit cost of doing it.

After a year's experience of carrying forward the work at full swing, the commission decided to face the situation frankly and attempt to ascertain exactly what might be expected. This investigation disclosed the fact that the estimates of the amount of work to be done were a little over 50 per cent short. Under the experience of one year's work it was calculated that the total cost of the canal would be $375,000,000, including sanitation, government, and payments to the New Panama Canal Company and the Republic of Panama, instead of $210,000,000, as these items would have aggregated under the estimates made in 1906. This was about one and a half times as much as the estimated cost of a sea-level canal. But, although Congress had fixed the limit upon the basis of an aggregate cost of $210,000,000, it cheerfully faced the restatement of the anticipated cost, and finally set the limit at $375,000,000.

From that day forward the great effort at Panama was to live within this limit, in spite of the extra work required. While Congress might have been willing to increase this limit, in view of the fact that an additional 97,000,000 cubic yards of material had to be removed, it was not asked to do so. The engineers desired above everything else to stay within their own estimates, and they did the extra work with money saved by increasing the efficiency of the force.

The first law providing for the government of the

Canal Zone was enacted in 1904. It gave to the President and those appointed by him the right to govern the Zone and imposed the duty "of maintaining and protecting its inhabitants in the free enjoyment of their liberty, property, and religion."

In 1907 an effort was made to reduce wages on the canal. The sundry civil bill of that year carried a provision that wages on the Isthmus for skilled and unskilled labor should not exceed more than 25 per cent the average wage paid in the United States for similar labor. This proposition was urged by Representative James A. Tawney, of Minnesota, then chairman of the Appropriations Committee of the House. When it came to a vote the wages fixed under Chief Engineers Wallace and Stevens were upheld by a vote of 101 to 10. Congress took the ground that the canal could be built only by the most liberal treatment of the people who were building it.

At another time a provision was inserted in the appropriation law establishing the 8-hour day law for American workers on the canal. A fight was made by the American Federation of Labor and other organizations to make it apply to the common laborer as well as to the Americans, but this was unsuccessful. The 8-hour provision did not work well, since the foremen and superintendents were permitted to stop work after 8 hours, while the laborers under them had to work an hour longer. This was later rectified by providing that the 8-hour law should not affect foremen and superintendents in charge of alien labor; and thus was overcome the difficulty of having an army of common laborers at work

an hour or so each day without superintendence or direction.

In 1906 it was provided by a joint resolution of the Senate and House that the purchase of material and equipment for use in the construction of the canal should be restricted to articles of American production and manufacture, except in cases where the President should deem prices extortionate or unreasonable. This provision undoubtedly increased by many millions of dollars the cost of the machinery with which the canal work was executed. While some dredges and other equipment were purchased in Europe, foreign purchases were the exception rather than the rule. When bids were submitted there were times when European prices of dredges were placed at less than $700,000, while American prices for the same dredges would amount to more than $1,000,000. When there were such marked difference in bids the awards were made to the European manufacturers.

Although the construction of the canal was authorized by the Spooner Act in 1902, it was not until 1906 that Congress expressed its views in legislation on the question of the type of canal that should be built. It was then that it declared the canal should be of the general lock type proposed by the minority of the board of consulting engineers, which was a complete approval of the plans urged by President Roosevelt. In order to make certain this decision as to the type of canal, a provision was incorporated in the appropriation bill of that year, setting forth that no part of the sums therein appropriated should be used for the construction of a sea-level canal.

Congress was always willing to aid the engineers in meeting unforeseen contingencies by giving them unusual liberties in the application of moneys appropriated. It was provided that as much as 10 per cent of any appropriation might be used for any of the other purposes for which money was appropriated, thus allowing the necessary leeway to insure a systematic progress of the work throughout all its features. This provision many times came to the rescue of the chief engineer, when he found that more money was needed at one point and less at another than had been estimated 16 or 18 months before.

While President Roosevelt was in the White House Congress gave him abundant authority over all phases of the task at Panama. He was empowered to do almost anything he thought expedient for hastening the work. For instance, in 1907 when he considered building the canal by contract, Congress provided that nothing in the Spooner Act should prevent him from entering into such contract or contracts as he might deem expedient for the construction of the canal. This practically gave him full authority over the limit of cost and the methods of building. He was thus the sole judge of the character of the contracts that he might make. No President in the history of the country ever was vested with fuller jurisdiction and control over a great matter than was President Roosevelt in this case. That he did not enter into such contract was due mainly to the reports made to him by Col. George W. Goethals, who had just been appointed chief engineer.

In 1908 the Secretary of War was authorized

to purchase for the Panama Railroad Company two steamships of American registry of not less than 9,000 gross tons each, the cost of which should not exceed $1,550,000, for the transportation of supplies, equipment, and material, and of officers and employees of the Canal Commission. These ships, when no longer required for that service were to be transferred to the Secretary of the Navy for use as colliers or other auxiliary naval vessels. These ships carried the bulk of the cement used in building of the great locks, and more than paid for themselves in the saving of transportation charges which would have been levied by private carriers. In the appropriation act of 1909 Congress decided that the carrying of marine or fire insurance was bad policy for the Government, and provided that no such insurance should be carried by the Panama Railroad Company, but that it should be reimbursed for any loss it might sustain from the appropriations made by Congress for the building of the canal.

There were a number of committees in Congress which dealt with canal legislation. Principal among these were the Committees on Appropriations of the two Houses, the Committee on Interoceanic Canals of the Senate, and the Committee on Interstate and Foreign Commerce of the House. The Appropriations Committees dealt with the question of appropriations. The House Appropriations Committee usually made a trip to the Isthmus before each session of Congress. There it would hold hearings, questioning closely every person connected with the work who had made estimates for its benefit, its members seeing

A NEGRO GIRL

A MARTINIQUE WOMAN

SAN BLAS CHIEF

AN INDIAN GIRL

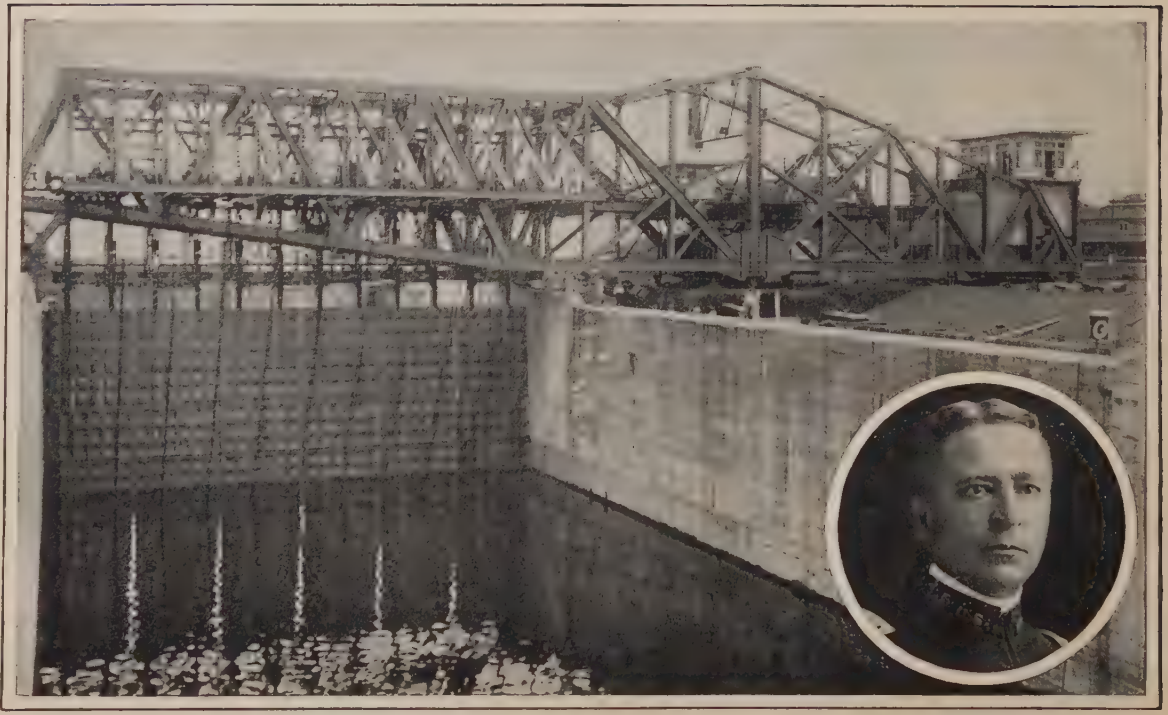
AN ITALIAN

A TIMEKEEPER

A SPANIARD

A NEGRO BOY

A FEW OF THE MANY TYPES ON THE ISTHMUS



TESTING THE EMERGENCY DAM, GATUN LOCKS

COL. HARRY F. HODGES

with their own eyes the projects for which each individual appropriation was asked. The practice was, during these visits, to go over a part of the work and then to hold sessions of the committee for the purpose of asking questions about that phase of the undertaking. The testimony was taken down by an official stenographer and printed for the use of every Member of Congress. A few months later the chairman and chief engineer would make a trip to Washington and furnish the committee with such supplementary information as the intervening time might have disclosed.

The Senate Committee did not visit the Isthmus as frequently, as it usually found that the hearings held by the House Committee afforded it sufficient information on which to predicate its action. All matters having to do with organization traffic, or general laws for the Canal Zone, were handled by the Committee on Interoceanic Canals of the Senate and the Committee on Interstate and Foreign Commerce of the House. It was the latter committee, under the chairmanship of Representative William C. Adamson, of Georgia, which framed the permanent Canal Law, under which the Isthmian waterway will be governed and operated. The big fight in Congress over the type of canal was waged before the Senate Committee on Interoceanic Canals. The records of this committee, together with the additional records in the hands of Congress, constitute one of the most extensive accounts of a great work anywhere to be found. The official literature of the Panama Canal is almost as voluminous as the canal is big.

Although Congress usually left the details of canal construction to be worked out by the Canal Commission and the President, from start to finish it showed a determination so to deal with the big project that it could look back over the work with the feeling that it had contributed its share to the triumph of the undertaking.

CHAPTER XXIII

SEA-LEVEL CANAL IMPOSSIBLE

NO ONE can dispute the wisdom of the United States in deciding to build a lock canal. To have undertaken a sea-level canal would have involved this Government in difficulties so great that even with all the wealth and determination of America, failure would have ensued. It is, perhaps, putting it too strongly to say that a sea-level canal is a physical impossibility, but it is not too much to say that such a canal would take so much money and so much time to build that the resources and patience of the American people would be exhausted long before it could be made navigable.

The advocates of a sea-level canal declared that a channel could be dug through Culebra Mountain with the excavation of 110,000,000 cubic yards. As a matter of fact, Culebra Cut, with its bottom 85 feet above sea level, required the excavation of almost that same amount.

Engineers who advocated a sea-level canal declared that the material in Culebra Mountain was stable, and that only moderate slopes would be necessary. As a matter of fact, the material in the mountain proved highly unstable, and, except for a few short sections, slides and breaks were encountered all during the construction period. The

result was that practically two Culebra Cuts were dug. The engineers, in beginning the present canal, calculated that 53,000,000 cubic yards would be excavated in Culebra; the amount actually removed was 105,000,000 cubic yards. Upon this basis a sea-level Culebra Cut might have required the excavation of 230,000,000 cubic yards.

Calculating an average monthly excavation of a million cubic yards, the task would have required 17 years to complete. In other words, if a sea-level canal had been undertaken and had been physically possible, the celebration of the opening of the waterway would have been set for 1925 instead of 1915.

Among all of the members of the majority of the board of consulting engineers who favored a sea-level canal, only one, E. Quellenec, Consulting Engineer of the Suez Canal, showed any appreciation of the difficulties which were to be expected in Culebra Cut. He announced, in voting in favor of a sea-level canal, that he could not do so without first reminding the United States Government of the great difficulties that would lie before it in Culebra Cut. Henry Hunter, Engineer of the Manchester Ship Canal, declared that Culebra Cut presented no serious problems at all; that a sea-level cut could be dug more quickly than the locks of the other type of canal could be built. He further declared that it was as clearly demonstrable as any engineering problem could be, that it would be possible to use 100 steam shovels in Culebra Cut. No one has accused the engineers on the canal of lack of ability in maneuvering shovels, yet at no time were they able to use more than 46.

If President Roosevelt had followed the recommendation of the majority of the board of consulting engineers in favor of a sea-level canal, it seems probable that the United States would have followed the French in retiring defeated from the Isthmus, or else would have reconsidered its purpose to build a sea-level canal and have undertaken a lock canal, as the French had done.

But, even if it had been possible to build a sea-level canal at Panama, it appears that such a canal would not have been as satisfactory as the present one. While the canal the United States possesses at Panama to-day is a great waterway 300 feet wide at its narrowest part, in which ships can pass at any point, the sea-level canal projected would have been a narrow channel winding in and out among the hills, too narrow for half its length for the largest ships to pass. Currents, caused by the Chagres River, and by the flow of other streams into the canal, would have made navigation somewhat dangerous.

The principal ground upon which the majority members of the board of consulting engineers voted in favor of a sea-level canal was that it was less vulnerable. This contention, in the light of what has happened at Panama, seems to carry no great weight. Such a canal would have required a masonry dam 180 feet high across the Chagres at Gamboa, to regulate the flow of that river into the canal. This dam, very narrow and very high, would have been a much fairer mark than the great Gatun Dam for the wielder of high explosives. Furthermore, while earth dams, like that at Gatun, have weathered earthquake shocks of great sever-

ity, masonry dams, like that proposed for Gamboa, have been tumbled to the earth by shocks of much less power. The regulating works at Gatun will take care of a volume of water approximately twice as great as the Chagres has ever brought down. On the other hand, the proposed dam at Gamboa would have cared for only one-third as great a discharge as the highest known flow of the Chagres.

It was calculated that the lake made by the dam at Gamboa would always be held at low stage between floods, but if two floods came in quick succession this might have been impossible. Such a situation would have made the Chagres River always a menace to the canal, instead of its most essential and beneficent feature.

Those who objected to the lock type, on the ground that the locks could be destroyed, seemed to forget that even the sea-level project demanded a set of locks to regulate the tides of the Pacific. While, contrary to the usual idea, there is no difference in the mean level of the Atlantic and the Pacific Oceans, the difference in the tides at Panama is about 18 feet. This is due to the shape of the Bay of Panama. As the tide sweeps over the Pacific and into that bay, it meets a funnel-shaped shore line, which gradually contracts as the tide travels landward. The result is that the tide rises higher and higher until it reaches a maximum of 10 feet above average sea level. When it flows out it reaches a point 10 feet below average sea level, thus giving a tidal fluctuation of 20 feet. On the Atlantic side the tidal fluctuation is only 2 feet.

Under these conditions the canal could not be operated during many hours of the 24 without the

tidal locks, if at all, and it would be almost as great a hindrance to have the tidal locks destroyed as to have the present locks injured. Another perpetual menace in a canal with a bottom width of only 150 feet for half of its distance, would be the danger of a ship sinking and blocking the channel. When the *Cheatham* sank in the Suez Canal it wholly blocked the waterway for nine days, and partially blocked it for a month.

According to the Isthmian Canal Commission, the present canal affords greater safety for ships and less danger of interruption to traffic by reason of its wider and deeper channels; it provides for quicker passage across the Isthmus for large ships and for heavy traffic; it is in much less danger of being damaged, and of delays to ships because of the flood waters of the Chagres; it can be enlarged more easily and much more cheaply than could a sea-level canal. The lock canal has a minimum depth of 41 feet, and less than 5 miles of it has a width as narrow as 300 feet. It can take care of 80,000,000 tons of shipping a year, and, by the expenditure of less than $25,000,000 additional, can increase this capacity by at least a third. It can pass at least 48 ships a day, doing all that a sea-level canal could do, and many things that a sea-level canal could not do.

No one denies that if it were possible to have a great Isthmian waterway at sea level as wide as the present lock canal, it would be the ideal inter-oceanic waterway. But, as such a proposition is out of the question, the American people have at least one thing for which to thank Theodore Roosevelt — that at a critical time in the history

of the canal project he allowed himself to be converted from the advocacy of a sea-level canal to the championship of a lock-level canal, in the face of a majority report of one of the strongest boards of engineers ever assembled, and prevented a situation at Panama that would have been humiliating to America, and which probably would have ended for all time the efforts of centuries to let ships through the American Isthmus.

CHAPTER XXIV

FORTIFICATIONS

WHEN Congress decided that the Panama Canal should be regarded as a part of the military defenses of the Nation, it became necessary to fortify it in such a way as to make it practically impregnable to naval attack. It was, therefore, decided that there should be ample coast defenses at the two ends of the canal and that these defenses should be protected from land attack by the quartering of a sufficient number of mobile troops to hold in check any landing parties that might attack the works by an overland route.

In carrying out this plan Congress met every demand of the military experts. When the plans for the fortifications were pending before the Appropriations Committee of the House every military authority, from Gen. Leonard Wood and Col. George W. Goethals down, who appeared before the committee was asked if he considered the defenses recommended as sufficient for the purposes intended, and each replied in the affirmative.

These defenses consist of large forts at each end of the canal, with field works for some 6,000 mobile troops. The defenses on the Pacific side will be somewhat stronger than those on the Atlantic side,

probably for the reason that better naval protection ordinarily could be afforded to the Atlantic than to the Pacific entrance, on account of the proximity of the Atlantic waters of the canal to American shores.

At the forts on the Atlantic side four 12-inch guns, sixteen 12-inch mortars, six 6-inch guns and four 4⅞10-inch howitzers will be mounted. The guns at this end of the canal will be distributed between Toro Point on the west side of the entrance channel and Margarita Island on the east side. There will be two big 14-inch disappearing guns at each of these points. They will be so placed as to sweep the horizon in the seaward direction, and at the same time will be able to concentrate their fire on the enemy as he steams in toward the channel entrance between the great breakwaters which cut off Limon Bay from the ocean.

At the Pacific end all of the defenses will be on the east side of the channel. They will consist of one 16-inch gun, six 14-inch guns, six 6-inch guns and eight 4⅞10-inch howitzers. There are three small islands on the east side of the Pacific entrance channel known as Naos, Perico, and Flamenco. They rise precipitously out of the water and offer ideal sites for heavy defense. A huge dump or breakwater has been built from the mainland at Balboa out to Naos Island and this, in turn, has been connected with Perico and Flamenco by large stone causeways. The great dump has made several hundred acres of available land for quartering the eight companies of coast-defense troops which will be stationed at the Pacific end of the

canal. These islands are 3 miles from the mainland and their guns will completely bar the way to any hostile ships which might seek to enter the canal.

On the other side of the channel, at a distance of about 12 miles, lies the island of Taboga where the Canal Commission maintains the sanitarium for its employees. It had been suggested by some that fortifications should be planted there, but it was declared by the military authorities that the guns of Naos, Perico, and Flamenco would completely command this island and prevent a hostile nation from using it as a base of operations.

The range of the guns extends more than a mile beyond Taboga Island. The big 16-inch gun which will be mounted on Perico Island is the largest ever built. It was made at the Watervliet Arsenal. It carries a projectile weighing more than a ton for a distance of 21 miles. At 17 miles it can toss its death-dealing 2,400-pound shell at an enemy as accurately as a base-ball player throws a ball to a team-mate 17 yards away. Its projectiles are filled with powerful explosives, a single one of which in the vitals of any battleship would be enough to place it out of commission. The big guns and the mortars are intended primarily for defending the canal from attack by water. The smaller guns and howitzers would come into play when an enemy approached within a mile and would be used to repel his efforts to effect a landing. Nearly all of these howitzers may be moved from place to place to meet the needs of the field troops in case of land attack. Eight of them will be permanently stationed at Gatun Locks. There

will be other field works at Gatun, Miraflores, and Pedro Miguel ready for occupancy at a moment's notice by the field troops stationed on the Isthmus. These howitzers are so located that 12 of them may be concentrated at any given point in case of danger.

The big guns of the permanent forts are all mounted on disappearing carriages so that they are exposed to fire only at the moment of discharge. The 12-inch mortars will not only play their part in defending the canal from water attack, but will be able to sweep the country on the Atlantic side as far inland as the Gatun Locks and on the Pacific side as far inland as the locks at Miraflores. They have a range of nearly 4 miles, and when loaded with shrapnel will prove a most effective weapon against field troops operating anywhere within the vicinity of the locks.

The land lying contiguous to the sea-level ends of the canal will be platted off into squares exactly as a city is laid out. Should hostile troops come upon this territory the men in the fire-control station would simply ascertain the number of the block or blocks on which they were operating, and the mortars would be so oriented as to throw their big projectiles thousands of yards into the air to fall directly on those blocks. They would, therefore, be practically as useful in land operations as in the water defense.

Every feature of the armament defending the entrance of the canal will embody the latest improvements known to military science. The carriages for the big guns have been specially designed, and were put through the most thorough

and exacting tests before their adoption. The fire-control stations are said to be the last word in insuring the effective use of the guns. Determining how a big gun shall be aimed so that its projectile will hit a target 10 miles away is not an easy task. Of course, the gun can not be pointed directly at the target, since this would cause the projectile to fall far short of the enemy, and also the effect of the wind and the motion of the enemy would carry it wide of its mark. To guess the range and to secure it by experimentation would be to prevent any effective fire whatever. Therefore, it is necessary first to determine the approximate range, the motion of the enemy and the velocity of the wind.

There is an ingenious instrument known as the range finder, by which the approximate distance of the target is determined. This instrument looks something like a cross between an opera glass and a small telescope. The operator puts his eyes to the opera glass part of the range finder and locates the enemy just as one would with an ordinary pair of glasses. When he locates the hostile ship he sees two images of it. There is an adjusting screw which he turns until the two images blend together and become one. The turning of this screw automatically adjusts a scale on the instrument, and when the two images exactly coalesce the distance of the ship is registered on the scale. The operators in the fire-control station make the necessary calculations as to the effect of the wind, the motion of the enemy and other elements entering into marksmanship, and telephone the results below to the men who aim the gun.

It takes two men to aim each gun; one takes care of its up-and-down movement, and the other of its right-and-left movement. When the man in the fire-control station telephones that the enemy is so many miles away, the man who has charge of the up-and-down movement of the gun so adjusts his telescopic sight on a registering scale that when it is pointed directly on the enemy the muzzle of the gun will be elevated high enough to carry the projectile that distance. The man who has charge of the right-to-left movement adjusts his sight so that when it is pointed directly at the enemy the muzzle of the gun will be pointed far enough to the right or to the left to land its projectile amidship on the enemy. Each man stands on a platform and operates a little wheel on an endless screw. He turns this wheel backward or forward just enough to keep his sight exactly on the enemy.

After the gunners have received their instructions the first shot is fired. This is called a "ranging" shot, and as the best range finder can not register the distance to the exact yard it is necessary for the fire-control station to gauge exactly how far short of, or how far over, the target the projectile has carried. The up-and-down sight is adjusted in accordance therewith and usually the second, or at most the third, shot gets the exact range. This method of locating the enemy will be used on all the fortifications of the canal.

It is unanimously agreed by military authorities that no naval force will risk an open attack upon such fortifications, since almost inevitably it would result in the disabling, if not the sinking, of a number of battleships and a great crippling of the

enemy's force that he could not afford to risk unless he had first swept the seas of our own naval strength.

In order to make certain that no surprise attack could be successful, one of the most complete searchlight equipments to be found in any fortress in the world has been authorized for the canal fortifications. There will be 14 searchlights, with 60-inch reflectors, made so that they will send the brightest of white lights out to sea and over the land as far as the range of the guns may reach. These searchlights cost more than $20,000 each, and it requires a year to construct the big mirror which is placed in each of them. Electric plants at each fortress will generate electricity for the operation of the guns and of the searchlights.

In anticipation of sudden need nearly $2,000,000 worth of reserve ammunition will be kept on the Isthmus. There will be 70 rounds for the big 16-inch gun — enough to operate it constantly for two hours, providing for a shot about every two minutes. The big 14-inch guns will carry a shell weighing 1,400 pounds, propelled by a 365-pound charge of smokeless powder which will drive it through the air at an initial speed of nearly half a mile a second — enough momentum to carry it through at least 5 feet of wrought iron. The charge of powder by which these guns will hurl their projectiles on their death-dealing mission, generates a force which would lift the great Masonic Temple of Chicago 2 feet in a single second.

Three regiments of infantry, 1 squadron of cavalry, 1 battalion of field artillery, and 12 com-

panies of coast-defense troops will be permanently stationed on the Isthmus. The field troops, consisting of the infantry, cavalry, and field artillery, will be stationed at Miraflores, where permanent quarters will be provided together with the necessary drill grounds. These quarters will cost in the neighborhood of $3,000,000. At this point they can be maneuvered to advantage and moved to any part of the Canal Zone needing defense. It was originally intended to place these troops at Culebra on the east side of the channel, but this would necessitate their going a distance of about 5 miles to get to a point where they could conveniently cross with the artillery to the other side of the canal.

Quarters for eight companies of coast-defense troops are being established on the Naos Island dumps. Quarters for two companies of these troops are being provided at Toro Point, and for two other companies at Margarita Island. These will afford sufficient strength at the Atlantic side to man the guns temporarily, in case of hostilities, until any additional troops needed can be brought up. All of the troops, both field and coast defense, will be adequately housed and the permanent structures erected for them will be as substantially built as those of any modern army post in continental United States. There will be drill grounds large enough to maneuver the troops stationed on the Isthmus. Roads affording access to all parts of the Canal Zone have been built.

In addition to the provisions for the permanent forces on the Isthmus, additional field works will be provided to accommodate the 20,000 troops

which might be brought to the Isthmus in case of war. These field works will take the form of barricaded positions, entrenchments, and other protective breastworks which will enable the troops to undergo a state of siege. It has been estimated by the engineers that behind such works as have been planned one defender can stand off six assailants, so that a body of 20,000 mobile troops under these conditions could hold the Isthmus against a siege of 100,000 for a reasonable time. These field works will be constructed principally around Gatun and Pedro Miguel. The buildings for the permanent force stationed on the Isthmus will be constructed on the unit system so that any necessary expansion can be made.

The question of fortifying the canal was one which engaged the serious attention of Congress for a long time. There were two main viewpoints as to what policy should be pursued. One contention was that the canal should be made neutral, open to the ships of all nations, including the United States, on equal terms even in case of war between the United States and any other country. It was contended by those who took this view that to declare it neutral would render it immune from any attack and guarantee its perpetuity as a great commercial undertaking under the control of the United States.

They contended, furthermore, that the United States was bound, under the terms of its treaty with Great Britain, to make the canal neutral and that to fortify it would be to violate the Hay-Pauncefote treaty. They asserted that the United States was under solemn obligations to

recognize the principle of neutrality as applied at Suez and offered the express terms of the Hay-Pauncefote treaty in proof of their contention. This treaty provided that "the United States adopts, as the basis of the neutralization of such a ship canal, the following rules substantially embodied in the Convention of Constantinople, signed the twenty-eighth of October, 1888, for the free navigation of the Suez Canal; that is to say:

"First, the canal shall be free and open to the vessels of commerce and of war, all nations observing these rules on terms of entire equality so that there shall be no discrimination against any such nation, or its citizens or subjects, in respect of the conditions or charges of traffic, or otherwise. Such conditions and charges of traffic shall be just and equitable.

"Second, the canal shall never be blockaded, nor shall any right of war be exercised, nor any act of hostility be committed within it. The United States, however, shall be at liberty to maintain such military police along the canal as may be necessary to protect it against lawlessness and disorder.

"Third, vessels of war of a belligerent shall not revictual nor take any stores in the canal except so far as may be strictly necessary; and the transit of such vessels through the canal shall be effected with the least possible delay in accordance with the regulations in force, and with only such intermissions as may result from the necessities of the service."

It will be seen from this that the language of the treaty seems plainly to imply that the United

States had no right to fortify the canal. It is interesting to note, however, that when the controversy over the tolls between the United States and England arose, the English Government expressly conceded the right of the United States to fortify the canal and to exercise absolute rights of sovereignty so far as military considerations were concerned. It would constitute an interesting chapter in diplomatic history if someone would tell the real reason why the English Government waived its rights of demanding a neutral canal under the Hay-Pauncefote treaty.

Those who advocated the fortification of the canal contended that the United States had acquired practical sovereignty over the Canal Zone, and that thereunder it had a perfect right to provide for the defense of the territory. They asserted that the canal was undertaken because of the military necessities of the United States, as demonstrated by the trip of the *Oregon* from the Pacific to the Atlantic, during the Spanish-American War and that to fail to fortify the canal would be to lose the military advantages which its construction had given to the United States.

It was further contended that to allow the canal to be neutral would, in the case of war between the United States and some foreign power, compel the United States to keep its own warships out of the canal its own blood and money had built, or else compel its permanent operating force at Panama to commit a sort of legal treason by putting the enemy's ships through the big waterway on the same terms with American ships.

This contention was answered by those who took

the opposite view with the statement that all treaties would be suspended in case of war and that neutralization would cease between the United States and its enemies at such a time.

The other side replied that if this were true, it would then be too late properly to fortify the Isthmus, and that if the United States expected ever to deny to any country the neutrality provisions of the Hay-Pauncefote treaty, the fortifications should by all means be built in advance.

The long and earnest debate brought forth from some the prediction that England would not acquiesce in such a construction of the treaty, and from others the statement that under the terms of that instrument other nations had a right to protest against the fortification of the canal. In the face of these arguments, however, Congress determined by a substantial majority to fortify the canal, and the whole world has acquiesced. England not only did not protest, but in its toll controversy notes expressly declared that the United States had the right to fortify the canal.

CHAPTER XXV

FIXING THE TOLLS

LONG before the Panama Canal was finished shipping interests in every part of the world began inquiring minutely as to probable rates of toll, stating that it would be necessary for them to have this information before making plans to meet the changed conditions. Some wanted to plan construction of new ships, while others desired principally to readjust their transportation lines in accordance with the new conditions.

With this in mind, President Taft in 1912 recommended to Congress the passage of a law fixing the tolls and providing for the permanent operation of the canal. Congress, acting upon this recommendation, passed what is known as the Permanent Canal Law. In this law are stated the terms under which the canal may be used by the shipping world. It authorizes the President to prescribe, and from time to time to change, the tolls that shall be levied by the Government of the United States for the use of the canal. No tolls may be levied on vessels passing through the canal from one United States port to another. Provision was also made that tolls might be based upon gross or net registered tonnage, displacement tonnage, or otherwise, and that they might be

lower on vessels in ballast than upon vessels carrying cargo. When based upon net registered tonnage, for ships of commerce, the tolls can not exceed $1.25 per ton, nor be less, other than for vessels of the United States and its citizens, than the estimated proportional cost of the actual maintenance and operation of the canal. The toll for each passenger was fixed at not more than $1.50.

Acting under the law authorizing him to fix the rates within the limitations stated by the law itself, President Taft issued a proclamation fixing the toll at $1.20 per net registered ton on all ships of commerce, other than those carrying cargo from one United States port to another. The net registered ton is the unit of measuring a ship's cargo-carrying capacity, used throughout the world in general, and by British shipping in particular. It consists of 100 cubic feet of space, so that when a ship is measured its net registered tonnage is determined by the number of these units of space it contains. A ton of cargo seldom fills a hundred cubic feet of space; frequently it will not fill more than 40 cubic feet. The charge per ton of actual freight under this toll of $1.20 per net registered ton ranges from 44 to 80 cents a long ton upon the freight carried, depending upon the class of cargo. Such a toll adds from 2 to 4 cents per hundredweight to the freight rate between two points through the canal. It might cost 5 cents to take a barrel of flour from Colon to Panama, or vice versa.

While ships will be charged tolls on the basis of net registered tonnage, not all ships carry freight

upon that basis. In the majority of cases cargo is taken on at "ship's option" — either by weight or space. Forty cubic feet is estimated as the space occupied by an ordinary ton of freight, and ships usually carry cargo at rates based on that amount of space for each ton. The 40 cubic feet method of determining the amount of cargo carried is adopted by maritime interests because a long ton of wheat occupies about that amount of space. From this it will be seen that for the purpose of collecting tolls the United States allows 100 cubic feet of space for a ton, while the ordinary shipping firm allows only 40 feet per ton. Thus it happens that a shipowner charges the shipper for carrying $2\frac{1}{2}$ tons where the United States charges the shipowner for carrying 1 ton.

Notwithstanding the fact that the shipowner collects for the carrying of $2\frac{1}{2}$ tons where he pays toll on 1 ton, he still has to pay what seems, in the aggregate, a large sum of money each time his ship passes through the canal. An ordinary 5,000-ton ship will be charged $6,000 for passing from one ocean to the other. A ship like the *Cleveland*, the first around the world tourist steamer advertised to pass through the canal, will have to pay $14,000 for the 12-hour trip from Colon to Panama. A steamship like the *Lusitania* will have to put up some $30,000 for a single passage. The average ship will pay from $5,000- to $10,000 for its passage. This seems like a high rate, even though it does amount to only 2 or 4 cents per hundredweight of cargo, but when one takes into consideration the time saved in passing through the canal, and the cost of main-

taining a ship on the high seas, the rate becomes a reasonable one.

The average ship costs about 10 cents per net registered ton per day for keeping it in operation. Thus a 10,000-ton ship will save about a thousand dollars for each day its voyage is shortened. If this voyage be shortened by 20 days, the shipowner makes a net saving of $8,000 when he selects the Panama route over some other route. In fact, he may save even more than this, for the other route might involve the giving of additional space for bunker coal, which otherwise would be used for cargo. Convenient coaling stations mean a minimum of space required for the operation of the ship and a maximum of cargo-carrying capacity. In this way a merchant ship might save several thousand dollars additional by choosing the Panama route over the Strait of Magellan.

It is estimated that the tolls it will be necessary to collect to make the canal self-supporting will be $15,500,000 a year, since that amount will be required to meet the expense of operation and return 3 per cent interest on the investment. The $15,500,000 is made up of $3,500,000 for operations, $250,000 for sanitation and government and $11,250,000 for interest on the $375,000,000 the canal cost. This takes no account of approximately $10,000,000 which will be required for the support of the troops on the Isthmus. Should this be considered, the total annual charges to be made would approximate $25,000,000, but this, in the view of those who have considered the matter, is not a proper charge against the cost of operation.

It has been stated that a proper system of

finances would provide for the repayment of the cost of constructing the canal in a hundred years. This would mean an annual charge of $3,750,000, and would bring the total annual outlay, exclusive of the cost of protection, up to $19,250,000. From this viewpoint the canal will not be self-sustaining until the total traffic approximates 17,000,000 tons a year, which it will reach about 1925.

It has been estimated by Prof. Emory R. Johnson, the Government expert on canal traffic, that the total tonnage which will pass through the canal during the first year of its operation will approximate 10,500,000 net registered tons. Since the shipping of the United States is permitted to pass through without paying tolls, the tonnage upon which toll will be collected will yield a gross revenue of approximately $10,000,000. This will afford the United States an income of a little less than 2 per cent on the money invested, after paying the actual cost of operation. On this basis it probably will be four or five years from the opening of the canal before the returns will yield 3 per cent on the investment.

The ships of the world use approximately 75,000,000 tons of coal annually. The opening of the Panama Canal will save several million tons a year and the money thus saved will, in part, fall into the coffers of Uncle Sam. A vessel en route from Chile to Europe can save nearly enough in the cost of coal alone to pay the tolls that will be exacted at Panama.

When the United States came to frame its system of toll charges and collections, it was found

that there was a wide difference of opinion as to the right of the United States Government to exempt coastwise shipping from the payment of tolls. Under the Hay-Pauncefote treaty with Great Britain there was also a wide variance of opinion as to the question of whether the United States, as a matter of national policy, ought to exempt from the payment of tolls, ships trading between its own ports on the two coasts. These questions were argued pro and con, and Congress finally decided by a very close vote that the United States ought to allow ships trading between its own ports to use the canal free of charge. No foreign ships are permitted under any circumstances to engage in such traffic.

Those who advocated the exemption of ships trading exclusively between United States ports from the payment of tolls, did so on the ground that it would build up a wealthy American merchant marine which would be invaluable to the United States in time of war, and also that it would tend to reduce freight rates between Atlantic and Pacific points. They argued that every cent added to the cost of transportation through the canal would be reflected in freight rates between the East and the West.

Those who opposed the exemption of American coastwise shipping from the payment of tolls, asserted that the coastwise shipowners already had a monopoly on the handling of cargo between American ports, and that no further encouragement was needed. They argued that it would make little or no difference in rates whether tolls were charged or not, and that the only people who would

benefit would be the shipowners. They contended that the United States ought to charge everybody alike and use the tolls collected for the purpose of repaying the money it spent in building the canal. Some of them also contended that the Hay-Pauncefote treaty bound the United States to treat all shippers alike, and that the United States could not discriminate in favor of the American coastwise traffic without contravening the treaty with Great Britain. This view, however, did not prevail, and the law, as enacted, exempted coastwise shipping.

England immediately protested against this exemption on the ground that it was in contravention of the treaty between the two countries. The story of how the United States came to be bound by a treaty with Great Britain in the building of an Isthmian canal goes back for more than half a century. The year 1850 found the North American continent, north of the Rio Grande, in the possession of the United States, England, and Russia. The United States had only recently finished its continental expansion, and each of the two countries needed a canal to connect their east and west coasts. England had long possessed a west coast in Canada, but the United States had only recently come into possession of a Pacific seaboard. When it came to consider the question of connecting its two coasts the United States found that Great Britain was holding the position of advantage in the Isthmian region. It held the Bahamas, Bermuda, Jamaica, the Barbados, Trinidad, the Windward and Leeward Islands, British Guiana and British

Honduras; and held a protectorate over the "Mosquito Coast," now the east coast of Nicaragua. That protectorate covered the eastern terminus of the only ship canal then deemed possible.

Under these conditions the United States concluded that it was necessary for the support of the Monroe doctrine that some sort of an understanding should be reached between the two countries. England assented to such an understanding only after Nicaragua and Costa Rica had given to the United States its consent to the building of a canal across its territory. These treaties with Nicaragua and Costa Rica were negotiated but never ratified, and were used as a club to force Great Britain to make a treaty. The result was the Clayton-Bulwer treaty, which provided that neither Government should ever obtain or maintain for itself any exclusive control over an Isthmian canal, and that neither Government should ever secure for itself any rights or advantages not enjoyed by the other in such a canal. The proposed canal was to be entirely neutral, and the treaty set forth that the two countries agreed jointly to protect the entire Isthmian region from Tehauntepec to South America, and that the canal always should be open to both countries on equal terms. The canal under this treaty was intended to be entirely neutral with reference to defense, with reference to tolls, and with reference to such other nations as might join in maintaining neutrality.

When the United States decided to build the Panama Canal, it found the Clayton-Bulwer

treaty wholly unsuited to its aims and desires. It therefore asked England to enter into a new convention; the Hay-Pauncefote treaty was the result. This document declared that its purpose was to remove any objections that might arise under the Clayton-Bulwer treaty to the construction of an Isthmian canal under the auspices of the Government of the United States without impairing the general principle of neutralization.

Under this treaty the Government of Great Britain made a protest against the decision of the United States to exempt its coastwise traffic from the payment of tolls, claiming such exemption to be a violation of the neutrality agreement. This protest came in the form of two notes to the American Government. The first was written as a warning to Congress that the British Government would regard the exemption of American coastwise traffic from the payment of tolls as a discrimination against British shipping, and a violation of the neutrality agreement between the two countries. It admitted that if the United States were to refund or to remit the tolls charged, it would not be a violation of the letter of the treaty, and acknowledged that if the exemption of coastwise American shipping from toll charges were so regulated as to make it certain that only bona fide coastwise traffic, which is reserved for American vessels, would be benefited by this agreement, then Great Britain could have no objection. But it declared that England did not believe that such regulation was possible.

After Congress, with this note in mind, had

passed the canal toll law with an exemption to ships carrying goods between the two coasts of the United States, President Taft, in approving the measure, declared that the canal was built wholly at the cost of the United States on territory ceded to it by a nation that had the indisputable right to make the cession, and that, therefore, it was nobody else's business how we managed it. He contended that for many years American law had given to American ships the exclusive right to handle cargo between American ports, and that, therefore, England was not hurt at all when that shipping was exempted from toll charges.

England responded, in a second note, that the clear obligation of the United States under the treaty was to keep the canal open to the citizens and subjects of the United States and Great Britain on equal terms, and to allow the ships of all nations to use it on terms of entire equality. It also contended that the United States is embraced in this term of "all nations"; that the British Government would scarcely have entered into the Hay-Pauncefote treaty if it had understood that England was to be denied the equal use of the Panama Canal with America. The three direct objections urged by the British against the American canal law were: That it gives the President the right to discriminate against foreign shipping; that it exempts coastwise traffic from paying tolls; and that it gives the Government-owned vessels of the Republic of Panama the right to use the canal free. The answer of the United States to the first of these

objections was that the right of the President to fix tolls in a way that would be discriminatory against British shipping was a question that could be considered only when the President should exercise such action.

The British Government expressed the fear that the United States, in remitting tolls on coastwise business, would assess the entire charges of maintenance of the canal upon the vessels of foreign trade and thus cause them to bear an unequal burden. This, the second objection was answered with the statement that, whereas the treaty gives the United States the right to levy charges sufficient to meet the interest of the capital expended and the cost of maintaining and operating the canal, the early years of its operation will be at a loss and, therefore, at a lower rate than Great Britain could ask under the treaty. The third objection was considered insignificant.

The British Government, after laying down its objections to the American canal toll law, requested that the matter be submitted to The Hague tribunal for adjudication. The American Government declared that this course would not be just to the United States, since the majority of the court would be composed of men, the interests of whose countries would be identical with those of England in such a controversy. Before leaving office President Taft proposed that the matter should be submitted to the Supreme Court of the United States. The whole question was left in that situation when the change from the Taft to the Wilson administration took place.

As to the merits of the controversy, there is no

unanimity of opinion on either side of the Atlantic. Some British authorities entirely justify the American position, while some American authorities take the British position. It is probable that the controversy will require years for settlement.

Before the canal was open for traffic there was much speculation as to what rate policies the railroads would adopt to meet the situation caused by the competition of the Panama Canal. If the same classes of goods are handled through the canal as across the United States, there will be more than 3,000 different articles on the tariff books of steamship lines using the canal. In his report on the effects of canal tolls on railroad rates, Prof. Emory R. Johnson expressed the opinion that the payment of tolls by ships engaged in coast trade would affect neither the rates of the regular steamship lines nor the charges of the transcontinental railroads.

A provision of the canal toll law forbids any railroad to be directly or indirectly interested in any ship passing through the canal, carrying freight in competition with that railroad. This provision was inserted to prevent the railroads from controlling the steamship lines using the canal, and through that control fixing rates between the two coasts on such a basis as to prevent effective competition with the railroads themselves. The result was that a number of railroads had to dispose of their steamships engaged in coastwise trade. This provision affects several Canadian railroads, and after it was made the British Government served notice on the United States that it intended to take up this

AN ELECTRIC TOWING LOCOMOTIVE IN ACTION

BLOWING UP THE SECOND DIKE SOUTH OF MIRAFLORES LOCKS

question and consider whether or not the law in this particular does not infringe upon British rights.

Nothing seems more certain than that, in the course of years, canal tolls will be materially lowered from the $1.20 fixed by the President. It seems inevitable that the Panama Canal and the Suez Canal will enter into a lively battle for the great volume of trade between eastern Asiatic and Australasian points and western European ports. On this dividing line between the two great interoceanic highways there originates many millions of tons of traffic, and this will be largely clear gain to the canal which gets it. The considerations which will draw this trade one way or the other are the rates of toll, the convenience of coaling stations, the price of coal, and the certainty of the ability to secure proper ship stores. This spirit of competition will probably serve to lower rates more rapidly than they otherwise might be reduced. With some 10,000,000 tons of traffic on the great divide between the two canals, ready to be sent forward by the route which offers the best inducements, it is certain that good business policy will call for some hustling on the part of both canals. As the business of the Panama Canal expands, it can afford to reduce rates. With an ultimate capacity of 80,000,000 tons a year, as the canal stands to-day, the rate of toll could be cut down to 25 cents a ton when that capacity is reached, and still afford the United States an income large enough to take care of the operation and maintenance of the canal, and sanitation and government of the Canal Zone, to meet the interest

on the cost of building it, and to amortize the entire debt in a hundred years.

It is certain that the United States made a good investment at Panama. Assuming that the coastwise traffic is worth to the Government the amount of the tolls it is exempted from paying, the canal becomes a self-supporting institution from the day of its opening, leaving all the military and trade advantages it affords the United States as clear profit.

CHAPTER XXVI

THE OPERATING FORCE

IT WILL require a force of about 2,700 persons to operate the Panama Canal. The major portion of this force will be engaged on the port works at the two ends of the waterway. With a large mechanical plant at Balboa, with large docks for the transhipment of cargo, and with other facilities required for making the canal the best equipped waterway in the world for handling marine business, more men will be needed for the conduct of the auxiliary works than for actually putting ships through the locks.

The force required at the locks will be comparatively small. It will consist of men in general charge of the lock operations, men in charge of the towing operations, men who handle the various mechanism and operate the several types of valves for the regulation of the water in the locks; and the general labor force consisting of a few hundred operatives at each end of the canal. A force will be required to operate the big hydroelectric station at Gatun Spillway, where the electricity for the operation of the locks and for the lighting of the canal will be generated. Another force will be required at the auxiliary power plant at Miraflores which will be operated by

steam. Fewer than a thousand men will be required in putting ships through the canal.

When the question of placing the canal on a permanent operating basis arose one of the first considerations was the scale of salaries to be fixed. Having in mind the fact that salaries paid during the construction period (which were 50 per cent above the standard in the United States) were based upon conditions existing in the early days of the American occupation, it was decided that this was an unfair basis for the permanent organization. The salaries for the construction period were made high because they had to be. It was more a question of reducing men to risk their lives than of fixing fair rates of compensation. The conclusion reached was that there was no longer any reason why the Government should pay salaries so much higher than obtained in the States, especially in view of the fact that all positions under the permanent organization would carry with them free quarters, free medical attendance, free fuel, free light, free hospital service and the like. It was finally determined that it would be fair to both the employee and the employer to establish as a basis of compensation for services in the permanent organization a scale of salaries not to exceed 25 per cent higher than obtained for similar positions in the United States. This decision was made on the basis that it would be fair to the employee and at the same time would allow the canal to be operated at a cost which would impose no undue burden on shipping.

When Congress took up the matter in the enactment of the permanent canal law, it reflected

the recommendations of the chairman and chief engineer of the Canal Commission in almost every particular. With reference to the canal employees, that body provided that they should be appointed by the President or by his authorities, and that they should be removable at his pleasure; also, that their compensation should be fixed by him until such time as Congress should regulate it by law.

The head of the permanent force on the Canal Zone will be known as the Governor of the Panama Canal. He is to be appointed by the President with the advice and consent of the Senate, for a four-year term, or until his successor shall be appointed and qualified. He will receive a salary of $10,000 a year, and will be the personal representative of the President on the Isthmus. Indeed, the permanent organic act provides that the President himself is authorized, after the disbanding of the Isthmian Canal Commission — which is to take place whenever the President thinks the work has approached a sufficient degree of completion to warrant it — to complete, govern, and operate the Panama Canal, and to govern the Canal Zone, if he desires to do it himself; or "cause it to be completed, governed, and operated through a governor of the canal." Of course, the President will prefer to "cause it to be completed, governed, and operated" through such a governor. As a matter of fact, when the question of selecting a governor comes before the President it may be expected that he will choose a man in whom he has every confidence to carry out the organic law on the Canal Zone, and to

place the canal in operation. This man will be as much of an autocrat on the Zone under the permanent organization as the chairman and chief engineer was during the construction.

When President Roosevelt undertook to carry out the provisions of the Spooner Act, and to have the canal dug by a board of seven commissioners, each independent of the other, he soon found that it would not work. After repeated trials he came to the conclusion that the control of affairs on the Isthmus should be concentrated largely under the chairman and chief engineer. He therefore issued an executive order requiring that all officials on the Isthmus should report to the chairman and chief engineer, giving him practically all control over the entire project. This brought both the Canal Zone Government and the sanitary department under the supervision of the chairman and chief engineer. The result was a coordination of the work and a satisfactory organization for its prosecution.

When Congress came to make the permanent canal law it profited by the unsatisfactory results that would have grown out of a rigid adherence to the principles of the Spooner Act, and concentrated all authority under the governor of the Canal Zone. There were those who thought the sanitary department should not be under the control of the governor, and still others who felt that the operation of the canal probably should be under one man and the civil government under another. But these suggestions were not followed, and the act as finally adopted makes the President practically a czar of the Isthmus, and

under him the governor need give account to no one but the President.

It has been the ambition of the present chief engineer of the canal to see the operating force fully installed and things moving along on a satisfactory working basis before leaving the Isthmus. He thinks arrangements should be made whereby acute changes of policy should be prevented. This he would do by having a principal assistant who would succeed the governor at the end of his four-year term. This would permit a continuous policy and an unbroken line of action which, according to his view, would make for the efficiency of the operating force. In speaking of this phase of the matter, he stated that were a new man chosen at the end of the four-year term of his predecessor — a man who had had no previous experience on the Isthmus — there would always be a tendency to make radical changes.

He would have on the governor's staff a doctor from the Army to have charge of the work of sanitation on the Canal Zone, who would report directly to the governor. The quarantine officer, in his opinion, should be under the Public Health Service of the United States. Under the plan as adopted in the permanent canal law, any officer of the Army or of the Navy chosen to fill a position in the canal operating force will be paid the same salary as a civilian, with the exception that he would get only the difference between his regular Army or Navy pay and the salary his position carried.

It is estimated that the expense of operating the canal will amount to about $3,500,000 a year.

This includes the cost of operating a number of dredges which will have to be maintained in connection with the canal work. The estimate was made upon the amount of business handled at the Sault Ste. Marie Canal which has the largest traffic of any canal in the world.

There will be five departments for the operation of the canal outside of the work of maintaining the civil government and sanitation. The operating department will have charge of the operation of docks and wharves at the terminals, pilotage, lockage, and the lighting of the canal. It is estimated that it will cost $400,000 a year to maintain the terminals, $150,000 a year to light the canal, and that it will require 60 pilots, at $1,800 each a year, to take ships through. During the first years of operation it is believed that a single shift can handle all the business that comes, but, as the years go by, it may require two shifts and eventually three to keep the work going.

The engineering department will require about 500 men and will have charge of all the construction and repair work pertaining to the canal property, and of all excavation and dredging in the canal. It will cost approximately a million dollars a year to maintain this department, of which three-fourths will be required for the operation of the dredges and other equipment for keeping the canal open.

The quartermaster's department will have charge of the construction, repair, and maintenance of all buildings, roads, and municipal improvements in the Zone settlements and of the receipt, care, and issue of all property and material. This department

will require nearly a thousand men and the total expense will be in the neighborhood of $600,000.

The electrical and mechanical department will have charge of the mechanical and electrical apparatus belonging to the canal, and of the permanent works at its two ends.

The accounting department will require some 60 men with annual salaries amounting to approximately a hundred thousand dollars. It is estimated that the cost of materials for the operation of the canal will range around three-fourths of a million dollars a year.

The force which will be maintained on the Isthmus, with their families, will make a Canal Zone population of approximately 5,000. These, in addition to the eight or nine thousand troops and marines which will be quartered there, will bring the total population up to about thirteen or fourteen thousand. Of these perhaps three-fourths will be along the southern 10-mile section of the canal. But, in spite of the greater population at the Pacific side, the Atlantic end will probably not lack for attraction. It is likely that Gatun Lake will be stocked with a supply of fresh-water fish, and that shooting preserves will be established adjacent to Gatun, to be conducted in connection with the Washington Hotel at Colon. There is also some talk of constructing golf links adjacent to Gatun, which will be open alike to the employees of the canal and to the guests of the two big Government hotels — the Washington and the Tivoli.

While a freight-carrying steamer will make its stay as short as possible, the probabilities are

that the passenger-carrying steamer will require at least 48 hours to make its calls at the two terminal cities and pass through the canal. They will probably handle the major portion of the package cargo, leaving the bulk cargo business entirely for freighters. When going through the canal from the Atlantic to the Pacific they probably will have cargo bound for a large number of Pacific ports on diverse routes. This would be discharged at Balboa and there be put into other ships to be carried to its destination. During the time the shipping and unshipping of cargo, replenishing stores, taking on coal and like operations are being performed, the traveler will be afforded opportunity to get acquainted with dry land again, and to enjoy for a day or two a respite from his long sea journey.

The plan advocated on the Isthmus for perfecting the permanent organization was as follows: The chairman and chief engineer would call upon each of the departments to furnish a list with the ratings of the best men. The man having the best record would be offered a position under the permanent organization similar to the one held by him under the construction organization. If he chose to accept this position under the wage standard laid out he could do so; if he did not, the next man would be given the opportunity, and so on down. In this way it was expected that the entire force would be chosen because of records made in the service.

CHAPTER XXVII

HANDLING THE TRAFFIC

FOUR or five years before the earliest probable opening date, shipping interests began to arrange their future schedules with respect to the Panama Canal.

One can scarcely realize how rapidly the facilities of the canal will be utilized. At the rate of expansion witnessed in the world's marine traffic during the past two or three decades, 17,000,000 tons of shipping will be handled through the canal in 1925, 27,000,000 tons in 1935, and 44,000,000 tons in 1945.

The maximum capacity of 80,000,000 tons assumes a passage of 48 vessels a day through the canal, or one for every half hour of the twenty-four. Two vessels a day of 4,000 tons each, at the present charge, will render the canal self-supporting.

While the great Isthmian highway will be completed far enough ahead to be ready to handle all traffic that offers long before the official opening date, it will, on the other hand, never reach that stage where dredges will not be needed. There are 22 rivers which wend their way from the watersheds of the canal, and pour their loads of sand and silt into it. Of course, these rivers are small — so small, indeed, that few of them

would be dignified by being called rivers in the United States. But when the heavens open and the floods descend, as they do so frequently during the rainy season at Panama, these usually quiet, lazy, little streams become almost as angry as the mighty Chagres itself, and they rush down to the canal heavily freighted with sand and silt. If the water in the great interoceanic channel is to be kept at its appointed depth of 41 feet, dredging perforce must be continued from year to year, summer and winter, spring and fall. And so it is that the dredges will be met by every ship that steers its course from Cristobal to Balboa, or from the Atlantic to the Pacific.

Few ships large enough to tax the dimensional capacity of the locks ever will go through the canal. Full 90 per cent of all the ships that sail the seas could go through locks one-half the size of those at Panama. So far as commercial shipping is concerned, a 15,000-ton vessel plying tropical waters is considered large, and a 20,000-ton ship is an exception. According to the best shipping authorities, the day when vessels of more than 25,000 tons will find it profitable to ply on the routes which lead through the Panama Canal is so far in the future that they are not able to discern it. With reference to the Navy, naval experts generally agree that the United States will celebrate many a decade of passing years before a battleship too large to use the present lock chambers is a possibility.

When a ship makes its maiden voyage through the canal, the measurements to determine its net register will be taken by the shipping experts

in the employ of the United States. When this work is completed the master of the ship will be required to pay the toll before he can take his vessel through the canal. If he should fail to pay the toll the vessel itself would be put on the block and sold at auction, if necessary, to reimburse the United States for its passage. However, it is not to be expected that such contingencies as these will arise. When once a ship has been measured, the formality will not have to be gone through with on future visits. It is not expected that each ship will be actually measured for every dimension as it comes to the canal on its first trip, since its net register tonnage probably will have been determined long before, and the canal officials will only check up the work already done elsewhere to assure its accuracy.

Many ships will go to Panama which will not use the canal. For instance, there will be those which will leave European ports, loaded in part with cargo bound to Pacific points and in part with cargo for Atlantic points on the South and Central American coast. Such ships will simply call at Colon, discharge their cargo bound to Pacific points, and take on what additional cargo they can get bound for points for which they are sailing on the Atlantic side. In stopping at Colon they will probably replenish their supplies from the commissary department of the canal.

What the freight department is to a railroad the cargo ship will be to the Panama Canal — its greatest revenue producer. Such ships will do comparatively little loading and unloading of cargo at either end of the canal. The tramp

steamer will figure largely in the traffic that passes from ocean to ocean at Panama. With no schedule of sailing dates and with no definite routes, the tramps constitute the flying squadron of the shipping world, moving hither and thither seeking cargoes wherever they can find them. A tramp steamer may load at Liverpool for San Francisco, reach that point through the Panama Canal, and, after discharging its cargo, go on up to Seattle and load for China. There it may discharge its cargo again and go thence to India to pick up a load of grain for Liverpool, passing through the Suez Canal. Its master always will turn its prow to the point where profitable cargo awaits it, and this may carry it by Panama once or a dozen times a year. The line steamers will have their regular sailing dates and will pass through the canal at stated intervals.

The problem of providing coal for passing ships is one of the most important with which the canal authorities will have to deal. The cheaper that commodity can be sold to the ships, the more attractive the route will be. For instance, a 10,000-ton ship which saves a dollar a ton on a thousand tons of coal, saves the equivalent of the cost of operating the vessel for a period of from 24 to 36 hours, and this, with the rates at Suez and Panama on an equal basis, gives at least one day's advantage to the Panama route in figuring on a voyage. Pocahontas steaming coal costs $2.70 per ton laid down at Newport News. Under the carrying agreements with shipping interests that obtained during the construction period, this coal was carried to Panama

for $1.395 a ton. It is estimated that the canal colliers, which have been authorized by Congress, with a capacity of 12,000 tons of coal and with a speed of 14 knots, can deliver to the Isthmus a half million tons of coal a year. The saving which will be effected by having the coal carried by Government colliers is a large one. A merchantman would get $368,000 for delivering 264,000 tons of coal, while the cost of delivery by collier for the same amount would approximate $184,000. The average life of a collier is 20 years. The saving effected in these 20 years by the Government carrying its own coal would be large enough to pay back the million dollars which the collier cost, and to yield an additional profit of $2,630,000 during the life of the vessel.

The sale of coal at Suez, where an annual shipping traffic of some 21,000,000 tons is handled, amounts approximately to 1,000,000 tons. Thus, it will require two colliers to handle the coal when the canal opens, and two more 13 years later.

Not all the ships which use the canal will coal there. For instance, the Royal Mail Steam Packet Company, which was so forehanded in its effort to get a good share of the trans-Isthmian traffic that it acquired the Pacific Steam Navigation Company long before the canal opened, is building a coaling station at Kingston, Jamaica, where its ships will replenish their bunkers. This coaling station will, of course, always be at the disposition of the British Government in case of war, and of such British merchantmen that choose to pass that way.

Some ships will not negotiate the canal under their own power. Many small vessels steer so badly that their masters would be afraid to risk them going through without aid. For instance, the skipper of the Cristobal, one of the 6,000-ton cement-carrying ships bought by the United States a few years ago, declared, in discussing this phase of the matter, that he would be afraid to trust his vessel going through the canal under its own power. To ships not sufficiently responsive to their helms, Government tugs will be furnished.

Some skippers prefer to have their vessels towed by one powerful tug, while others prefer several smaller ones. Several tugs are now building for towing purposes, and they will also be used to tow vessels through the locks in the early days of operation, pending the completion of all of the electric towing locomotives.

Two floating cranes will be provided in the permanent equipment at a cost of a quarter of a million dollars each. These cranes, with a lifting power of 250 tons, will be suitable for any wrecking operations in the canal and, also, for lifting the gates in case of repairs being required.

The canal will probably be the death blow to the sailing ship of international commerce. Not being able to negotiate the canal under their own power, and because of the dead calms which prevail in the Gulf of Panama, sailing ships will be stopped from using the Isthmian waterway. When they attempt to journey around Cape Horn and the Cape of Good Hope in competition with steam vessels which pass through the Panama

Canal, the operation will afford such little profit that in the course of a few years they will have to surrender what little share of international commerce they have succeeded in keeping.

The Panamans are inclined to think the United States drove a hard bargain when the provision was inserted in the treaty that all supplies for the building and operation of the canal, and for the demands of shipping using it, when imported by the United States, should be free of duty. This practically gives the United States a monopoly of the business of catering to the needs of ships passing Panama. The present duty on imports is 15 per cent, and the local merchant who would sell supplies to the passing ships would be under the necessity of adding 15 per cent to his buying price before he could compete with the United States Government on equal terms. This advantage is made all the more marked by the reasons of the fact that the United States often can make much money out of the operation by selling at actual cost, the profit arising from the extra shipping which is thereby attracted to the canal.

The United States will reimburse the owners of any vessels passing through the locks of the canal, under the control of its operatives, for any injury which may result to vessel, cargo, or passengers. Provision is made under the permanent canal law that regulations shall be promulgated by the President which will provide for the prompt adjustment, by agreement, and immediate payment of claims. In case of disagreement, suit may be brought in the district

court of the Canal Zone against the governor of the Panama Canal. The law says: "The hearing and disposition of such cases shall be expedited and the judgment shall be immediately paid out of any moneys appropriated or allotted for canal operation."

The character of misrepresentations made concerning the canal was illustrated in a story published in the midsummer of 1913. This story originated in London and declared that all of the big shipping interests were afraid of the Panama Canal, and that Lloyds would insure vessels and cargo only at much advanced rates. The article went on to state that the representative of one of the biggest European lines had visited the Isthmus and had returned with the announcement that his company could not afford to trust its vessels in the canal.

As a matter of fact, with the United States Government standing responsible for any damage sustained in the canal, no shipping interest could sensibly regard it as extra hazardous to pass through it; rather, it would be less hazardous than to negotiate the tortuous Strait of Magellan, where thousands of wrecks tell of unseen dangers, or to round Cape Horn with its fierce storms and its grave perils.

Much has been said about the probability of injury to the canal by persons of evil intent, and the Panama Canal law imposes heavy penalties on anyone attempting to inflict such an injury. The law provides that the governor of the Canal Zone shall make rules and regulations, subject to the approval of the President, touching the

right of any person to remain upon or pass over any part of the Canal Zone. "Any person violating these rules or regulations shall be guilty of a misdemeanor and, upon conviction in the district court of the Canal Zone, shall be fined not exceeding $500 or imprisoned not exceeding a year, or both penalties in the discretion of the court. Any person who, by any means or any way, injures or obstructs or attempts to injure or obstruct any part of the Panama Canal, or the locks thereof, or the approaches thereof, shall be deemed guilty of a felony and on conviction shall be punished by a fine not to exceed $10,000 or by imprisonment not to exceed 20 years, or by the infliction of both of these penalties. If the act shall cause the death of any person within a year and a day thereafter, the person so convicted shall be guilty of murder and shall be punished accordingly." As a further precaution, individuals will not be allowed to approach the locks with any sort of packages unless they are properly vouched for.

The possibility of serious injury to the locks will be carefully guarded against. They will be lighted at night by electric lamps of large candlepower and the whole lock structure will be kept as light as day throughout the night. Men will be always on sentry duty, and an adequate system of intercommunication will enable the sentries to call out a guard large enough to repulse any attack of any small surprising party.

CHAPTER XXVIII

THE REPUBLIC OF PANAMA

THE Republic of Panama is one of the smallest countries in the world, its territory being about equal to that of the State of Indiana. It has no national debt, and has $7,000,000 invested in mortgages, on real estate in New York City.

When it received $10,000,000 from the United States, in payment for the rights under which the Panama Canal was built, it immediately invested about 75 per cent of it, using the remainder for paying the expenses of the revolution, and for setting the new government on its feet. It now receives $250,000 a year from the United States as rental for the Canal Zone, and this, with the $350,000 received as interest from its real estate mortgages in New York, gives it an annual income of $600,000 outside of money raised by the usual processes of taxation.

Under the treaty with the United States, Panama has its independence guaranteed, and recognizes the right of the United States to maintain order within its boundaries. This entirely does away with the necessity of maintaining an army and navy. The result is that with no appropriations required for military purposes, and with a $600,000 income from the Canal

Zone, it enjoys one of the lowest tax rates in the world.

Although the Republic of Panama has its Declaration of Independence and its Glorious Fourth, the former was written by a foreigner, and the latter occurs in November. There is some dispute as to who wrote the declaration of independence, but the best information points either to Philippe Bunau-Varilla, a Frenchman, or to William Nelson Cromwell, an American. These two gentlemen differ upon this subject, each claiming that he was the Thomas Jefferson of Panama.

When the $10,000,000 was paid to Panama by the United States, one of the first things done was to build a university, locally known as the National Institute. Some $800,000 was spent in the construction of the buildings, which are located near the line of the Canal Zone. But it so happens that Panama has few teachers qualified to hold university chairs, and fewer students qualified to pursue university courses; and the result is that the university is more a place of buildings than a seat of learning.

No other country in the world calls in another nation to superintend its elections. When the first presidential election was held the United States took the initiative and demanded the right to supervise the balloting. Before the second election was held the President became ambitious to succeed himself, although the constitution provided that he could not do so. He thereupon decided to resign for a period of six months, in favor of one of his partisans, thinking that this would allow him to live up to the letter of the constitution

even though he were violating its spirit in becoming a candidate for reelection. This situation was brought to the attention of the United States, and the President was politely but firmly informed that the subterfuge would not be permitted. When the election approached each side thought that the other was trying to win by fraud, and the United States was asked to referee the political battle.

The City of Panama is famous for its wickedness. Men who have seen the seamy side of life in all of the big cities of the world declare that Panama is as bad as the worst of them. Until a few years ago bull-fighting was permitted, but the bulls were so poor and the fighters were such butchers that the Government finally outlawed this form of entertainment. Cock-fighting persists, and numerous cock pits are popular resorts every Sunday. Nowhere else can one witness a greater frenzy in betting than at one of these cocking mains. The backers of the rival birds nod their heads and place their bets so rapidly that it is more bewildering to the onlooker than the bidding at an auctioneer's junk sale.

The prize ring has succeeded the bull ring in gratifying the Spaniard's thirst for gore, and scarcely a Sunday passes that there is not a prize fight in Panama. Few Americans who attend them come away without a feeling of disgust over the poor fighting, the brutality, and the trickery resorted to.

While the Americans have done so much for public cleanliness in Panama and Colon, the masses seem to know little more about sanitary living today than before the Americans came. The stenches which greet the visitor in the native quarters are no less odorous than those encoun-

tered in other cities of tropical America. The bathtub is an unknown quantity among the masses. Most of the natives who live in the cities are engaged in some line of small trade. It may be that a shop has only a platter of sweetmeats and a few bottles of soda on ice, and that another has only a bushel of different kinds of tropical fruits, but out of the small sales large families manage in some way to exist. The markets open early in the morning. There is no spirit of rivalry among the market men, and they act usually as if they were conferring a favor upon the buyer. At the markets many Indians are encountered who bring their wares from the interior and offer them for sale. These usually consist of pottery, net bags, charcoal and the like.

Life among the Panamans in the jungle is simple indeed. With his machete the householder may provide a thatched roof for his mud-floored hut, and he can raise enough beans, plantains and yams, and burn enough charcoal, and catch enough fish to meet all of his needs. In the kitchen the principal utensils are gourds and cocoanut shells. The most tempting morsel that the Panaman can get is the iguana, a lizard as big as a cat, whose meat is said to taste like spring chicken. It is about the ugliest creature in the animal world, and yet it means more to the native Panaman than does possum meat to the cotton-field darky of the South.

The unconscious cruelty of the average native is remarked by almost every visitor. He is usually too lazy to be conscious of cruelty, for that would require exertion. When he catches the iguana,

for instance, he takes it alive so that it may be fattened before being killed. Its short legs are twisted and crossed above its back, and the sharp claw of one foot is thrust through the fleshy part of the other, so as to hold them together without other fastening. The tail, being useless for food, is chopped off with the machete, and thus mutilated and unable to move, the lizard is kept captive until fat enough to eat.

The fruits of Panama are neither so numerous nor so plentiful as those of Nicaragua or Jamaica. The mamei is a curious pulpy fruit the size of a peach, with a skin like chamois and with a smooth pit the size of a peach-stone. The sapodilla is a plum-colored fruit with seeds in a gelatinous mass. One is usually introduced to the sapodilla with the remark that, although the seeds are eaten, they have never been known to cause appendicitis.

Cedar is preferred to mahogany in Panama. The Indians make their cayucas out of mahogany logs, and it is not uncommon to see bridges 40 feet long and 5 feet thick, made of mahogany logs which would be worth several thousands of dollars in an American furniture factory.

Panama is famous for its tropical flowers. Many of them are beautiful, but few are sweet smelling. Orchids abound, especially on the Atlantic side, and while the waters of the Chagres were being impounded in Gatun Lake, native boatmen would go out in their cayucas and gather orchids from the trees. One of the most beautiful of the orchids of Panama is the Holy Ghost orchid. It blooms biennially, and when its petals fold back they reveal a likeness to a dove.

Some of the American women on the Canal Zone became enthusiastic collectors of tropical flowers. Among these were Mrs. David Du Bose Gaillard and Mrs. Harry Harwood Rousseau. Both of these ladies spent much time hunting orchids and other flowers for the verandas of their houses and for their gardens. Mrs. Rousseau made trips into several of the other countries of Central America in her quest for new orchids. The collections made by these two ladies represent the finest on the whole Isthmus of Panama.

The animal life of the Isthmus is not abundant, although some deer and a few tapirs are to be found. Alligators abound in the Chagres River and other streams of the Zone. Perhaps the most interesting form of animal life to be found on the Isthmus is the leaf-cutting ant. This ant seems to be nature's original fungus grower. As one walks around the American settlements, he frequently comes upon a long path filled with ants, passing back and forth. They resemble a sort of miniature yacht under full sail, except that the sails are green instead of white. Upon closer examination it is found that what seemed to be a sail is a triangular piece of leaf carried on the back of the ant, with its edges to the wind so as to overcome air resistance. The ants do not gather these leaves for food, but they store them in such a way that a fungus grows upon them. They eat the fungus, and when the leaves are no longer useful they are thrown out and new supplies brought in.

The native remedies used by the Panamans are many and interesting. For stomach troubles, which are very rare, they eat papaya. The papaya

is a sort of fruit which might be a cross between a cantaloupe, a watermelon and a pumpkin, except that it grows on trees. It has the rind of a green pumpkin, the meat of a cantaloupe, and the seeds of a watermelon. It is probably richer in vegetable pepsin than any other plant in existence — a pepsin which neutralizes either alkaline or acid conditions in the stomach. It is said that a tough steak, wrapped in the leaf of the papaya tree overnight, becomes tender as the result of the digestive action of the pepsin in it.

The Indians and Panamans who live in the jungle use the wood of the cacique, or "monkey cocoanut," to stop any flow of blood. In their materia medica they have a large number of tropical plants which they use for their ailments.

The way in which sanitary instruction may be made efficient is illustrated among some of the people of Panama. Upon one occasion the Canal Record carried a small diagram of how to make a sanitary drinking cup out of a sheet of paper. After that there were many Panamans who, although in a hundred ways indifferent to contagion, would no longer drink from common drinking cups, but would make their own sanitary cups. Even the Jamaican negroes employed around the offices of the commission in many instances would not think of using the common drinking glass at the office water-cooler.

Two tribes of Indians on the Isthmus have not mixed with the Caucasians or the negroes. They are the Chucunoques and the San Blas Indians. The latter tribe has never been known to allow a white man to remain in its territory after sun-

down. Even the higher officials of the Panaman Government are forced to respect this tradition when they treat with the San Blas chiefs.

Government land in Panama can be bought at the rate of $49.60 for 247 acres, with reductions for larger areas. The Government invites foreign capital, declaring that the United States stands as a perpetual guarantee against revolutions within and aggressions without.

The story of the early days in Panaman history is a strange admixture of romance and cruelty. The Isthmus was discovered in 1500, and first settled by an adventurer who had been the Royal Carver in the king's household at Madrid. Balboa, carrying with him a small force of men and a lot of bloodhounds, one of them a dog of mighty prowess, known as Lioncico, or "Little Lion," which drew a captain's pay because of its fighting qualities, crossed the Isthmus in 1513 and discovered the Pacific Ocean. After him came a new governor of the Isthmus, who put Balboa to death.

The Spaniards were unspeakably cruel to the Indians. Even those who received them kindly were tortured and roasted to death, because they did not produce enough gold. One governor rode a mule, which was noted for the frequency of its braying. The Indians were taught that the mule was asking for gold, and in meeting these demands they not only had to give what they possessed, but were forced to rob the graves of their ancestors as well. Upon one occasion the Indians, having captured a number of Spaniards, melted a lot of the yellow metal and poured it down their throats,

telling them to drink until their thirst for gold was quenched.

After the Spaniards had established themselves upon the Isthmus, the English buccaneers, Drake and Morgan, fell upon their cities and despoiled them. The ruins at Old Panama, which once was a city of 30,000 inhabitants, to-day tell the story of the effective work of Henry Morgan when he raided it and captured its treasure.

While the Spanish conquerors, the French filibusters, and the English buccaneers, who took their turns in pillaging Panama, were cruel beyond imagination, they were always famous for their outward evidences of religion and piety. The Spanish were always chanting hymns and honoring the saints; the French would shoot down their own soldiers for irreverent behavior during mass; the English pirate captains never failed to hold divine services on Sunday, and often prohibited profanity and gambling.

Where once Spaniards tortured Indians and British buccaneers raided Spaniards, where once revolution after revolution left a poor and desolate country, to-day the gates of Panama are open to the world, and its trade is invited again to pass that way. The people of the Isthmus believe that the glory which departed when Morgan sacked Old Panama, forcing the Pacific trade to seek the Strait of Magellan, will return with the opening of the Panama Canal, and that their capital, whose walls cost so much that the Spanish king thought he could see them from his chamber window in Madrid, will retrieve its ancient glory.

CHAPTER XXIX

OTHER GREAT CANALS

WHILE the Panama Canal seems destined to endure for all time as the greatest artificial shipway in the world, there are other waterways, while small in comparison, that are in themselves wonderful works of engineering. In point of traffic the greatest canal in the world is the Sault Ste. Marie Canal, popularly called the "Soo." In point of economy of distance and world-affecting consequence the Suez Canal ranks with, or next to, Panama.

The Suez Canal was built while the Civil War was raging in the United States, and was opened for the passage of vessels on November 17, 1869. It is about twice as long as the Panama Canal, the distance from Port Said, at the Mediterranean terminus, to Suez at the Red Sea end, being approximately 100 miles. When constructed its depth was 26 feet, 3 inches, and its bottom width 72 feet. The maximum vessel draft permitted was 24 feet 7 inches. The canal was in operation for 11 years before vessels of this draft presented themselves for passage.

During the first dozen years of its operation various curves were straightened, the turning-out places where vessels passed one another were enlarged, and their number increased to 13. This

work of straightening curves and widening the canal has continued from that time until the present, and to-day vessels may pass one another through a large part of its length. The policy increasing the general dimensions of the canal was begun in 1887. By 1890 its depth had been increased to $29\frac{1}{2}$ feet, so that it could accommodate ships having a draft of 26 feet 3 inches. The work of deepening continued, and when the United States began to build the Panama Canal this work was speeded up, so that by 1908 a depth of $32\frac{3}{4}$ feet was attained and vessels of 28 feet draft could be accommodated. In 1909 it was decided that it would be necessary to make the canal still deeper, and a project, which will not be completed until 1915, was then undertaken, calling for a depth of 36 feet 1 inch. By 1898 the width of the canal had been increased from 72 feet to $98\frac{1}{2}$ feet. This is now being still further increased to $134\frac{1}{2}$ feet. Even when this project is completed in 1915, the Panama Canal still can accommodate ships of 5 feet greater draft than the Suez Canal.

The maximum draft of ships permitted to use the Suez Canal is demanded in comparatively few instances. A recent report showed that 94 per cent of the ships using the canal had a draft of less than $26\frac{1}{4}$ feet, and that only 1 per cent had a draft of 28 feet. The increase in the depth of the canal, therefore, was made largely in anticipation of future shipping requirements.

When the canal was completed it required 49 hours for a ship to pass through it. The growth in its dimensions, together with the increase in the number and size of passing stations, the straighten-

ing of curves, and the improvement of facilities, have brought down to 17 hours the average length of time required for the transit. Ships not equipped with electric searchlights are not permitted to pass through at night. The improvements being made on the canal are being paid for mainly from the revenues derived from tolls.

The Suez Canal was constructed, and has been enlarged and managed, by a private corporation which has invested from the beginning of the construction up to the present time about $127,000,000 of which approximately two-thirds has been secured from the sale of securities, and one-third from the earnings. The original capital of the Suez Canal Company, issued in 1859, was 400,000 shares of $100 each. These shares partake of the nature of both bonds and stock, for they are entitled to interest of 5 per cent as well as to participation in the company's profits. Provision is made for their redemption, but when redeemed they continue to share in the profits and merely lose the interest-bearing feature. On December 31, 1911, 378,231 of these shares were in circulation.

In 1875 the British Government, through Lord Beaconsfield, purchased the 176,602 shares held by the Khedive of Egypt, paying some $20,000,000 for them. The British Government does not own a majority of the shares, and the Suez Canal is controlled and operated by a French company. The annual dividends have increased from 4.7 per cent to 33 per cent. The shares are closely held and trading in them is light. The stock sells at a premium of over 1,000 per cent. When the work of building the canal was undertaken, 100,000

shares were given to the founders. These shares are not stock, but are, rather, certificates of obligation, requiring the company to pay 10 per cent of its profits to the promoters and founders of the original company and their heirs and assigns. The net profits of the canal amount to about $17,000,000 a year. Of this the stockholders get $12,000,000, the Egyptian Government $2,500,000, the founders of the company $1,500,000 and the administrative officers and the employees divide $100,000 among them.

The traffic of the Suez Canal during the first two years was relatively small, for the reason that the canal is not a practicable one for sailing vessels, and steam vessels had to be built. These, being much less efficient than freight steamers are to-day, were slow in securing the trade that had been enjoyed by the sailing vessels. The rate of tolls charged by the Suez Canal Company has declined steadily since the canal went into operation. On January 1, 1912, they approximated $1.30 a ton, with a reduction of nearly a third for vessels in ballast. On January 1, 1913, the rate was made approximately $1.20 a ton, the fraction of a cent higher than the rate at Panama. The passenger tolls are $2 for passengers above 12 years and $1 for children from 3 to 12 years of age; children below 3 years are carried free. The highest toll charged on the Suez Canal was in 1874 when it was $2.51 a ton.

The Suez Canal has proved highly profitable to its owners. No one believes that the Panama Canal will yield as great a return on the capital invested. The cost of the Panama Canal will be

four times the cost of Suez, and it is doubted by traffic authorities whether the Panama Canal will ever handle as much business.

The Manchester Ship Canal, which connects Manchester with Liverpool, was constructed only after years of preliminary agitation. There was opposition by the railways, and from the industrial and commercial centers with which Manchester competes. Over 300 petitions were presented to Parliament before its consent was obtained for the construction of the canal. Work was begun in November, 1887, at which time it was estimated that the canal would cost $42,000,000. It was opened for traffic January 1, 1894, after $75,000,000 had been spent in building it. Of this about $60,000,000 went into actual construction work. The Manchester Canal is $35\frac{1}{2}$ miles long. It extends from Eastham, about 6 miles from Liverpool, to Manchester. Its original depth was 26 feet, but this has been increased to 28 feet. Ships with a length of 550 feet, a beam of 61 feet, a height of 70 feet, and a draft of 27 feet can use the canal. There is a difference of 58 feet 6 inches in level between Eastham and Manchester, and this is overcome by five sets of locks. The highest lift is 16 feet.

The Manchester Canal Company owns the Bridgewater Canal and makes connections with 13 other barge canals. It handles about 6,000,000 tons of freight a year, of which the bulk is seaborne. Although it connects with 13 barge canals, the amount of barge traffic handled is less to-day than it was a decade ago. From the beginning the Manchester Canal has had to compete with the

railroads, and they cut their rates to such a basis that they get the business and force the canal company to operate as a losing venture to its stockholders.

In spite of the competition of the railroads, the canal has managed to increase its business at about the same rate that traffic through the Suez Canal has increased, and a little more rapidly than it has been estimated that traffic through the Panama Canal will grow. The shareholders have not yet received any dividends, but it seems probable that in the course of a few years all of the securities will earn an annual income. Many shareholders have been more than compensated for their subscriptions by the collateral benefits they have received from the canal.

The Government of Germany constructed a canal connecting its Baltic and North Sea ports, and named it the Kaiser-Wilhelm Canal. The natural route from the Baltic to the North Sea around Denmark is circuitous, dangerous because of storms, and is guarded by foreign powers. The canal was begun in 1887 and completed in 1895, and was constructed primarily for military and naval purposes, although it has proved to be of great value to the commerce of Germany. It connects Brunsbuttel Harbor on the Elbe with Holtenau on Kiel Bay. It passes through low lands and lakes and along river valleys. It is 61 miles long and, as it was first constructed, had a width of 72 feet and a depth of 29½ feet. The total cost of the canal was approximately $37,000,000. It was in operation only 12 years until it was found necessary to enlarge it. The reconstruction

of the canal was authorized by the German Government in 1907, and the work, which is expected to be completed in 1914, was started in 1909. When this work is completed the canal will be 144 feet wide and 36 feet deep. At 10 places it will be widened so as to permit ships to pass. New twin locks, built for the regulation of the tides — for the canal itself is at sea level — will be 82 feet longer and 37 feet wider than the Panama locks. The maximum depth of these locks will be 45 feet, although at low tide they will be a little less than 40 feet.

During a recent year commercial vessels with an aggregate net register of over 7,000,000 tons used the Kiel Canal. The increase of business during the first decade of the present century amounted to 70 per cent, or a little more than the estimated increase for each decade at Panama. The net receipts from the operation of the canal are not sufficient to pay interest on the investment. No effort is made to levy tolls that will provide for interest charges, or for the amortization of the principal. The canal does not connect regions of enormous traffic, nor does it greatly shorten ocean routes. The longest route is cut down only 429 miles. The German Empire was so well pleased with the success of the Kaiser-Wilhelm Canal that the enlargement it is now making represents an expenditure one and a half times the original cost.

The Amsterdam Canal was built to connect Amsterdam with the sea. Formerly, ocean-going vessels were small and the Zuider Zee River was then a stream of considerable depth. Gradually, however, the Zuider Zee became shallower and the

size of ocean vessels larger, so that the commercial supremacy of Amsterdam was threatened by the competition of Rotterdam and Antwerp and north German ports. In 1818 a corporation constructed what was known as the "North Holland Canal," which was large enough to accommodate ships employed in the East India trade. It had a minimum depth of 20 feet and a minimum width of 100 feet. This canal, however, had numerous curves and it was constructed by a roundabout route of 52 miles from Amsterdam northward to the North Sea, while Amsterdam is less than 17 miles from the sea by direct route.

In 1863 a concession for the construction of the North Sea Canal was granted and two years later active work began. It was finished in 1876. There were no serious engineering difficulties to be met, there being no rivers to be crossed, no towns to block the way, and only three bridges to be built. The work consisted mainly of building embankments, draining and reclaiming land, and dredging the channel. The canal was not completed according to the original plan. Extensive enlargements and improvements were decided on, and a larger additional lock was undertaken in 1889 and completed in 1896. At that time it was the largest canal lock in the world. Plans are now being considered for building another new lock, which will be larger than those at Panama. The bottom width of the canal is now 164 feet. It can accommodate vessels 721 feet long, with a 79-foot beam and of 30 feet draft. The construction of the canal cost $16,000,000. Improvements have brought the total amount up to about $24,000,000.

Since 1893 all toll charges have been eliminated, and the canal has been operated at the expense of the State. The annual average cost of operation and maintenance is about $200,000. This canal bears about the same relation to the city of Amsterdam that the Delaware River Channel bears to the city of Philadelphia, or the improvements on the lower Mississippi to the city of New Orleans.

The Cronstadt and St. Petersburg Canal is 16 miles long and gives St. Petersburg an outlet to the Gulf of Finland. It was built at a total cost of about $10,000,000. It has a minimum width of 220 feet and a navigable depth of about 20½ feet. It was built primarily as a military undertaking, but has proved of great service to Russian commerce.

Another important European canal is that extending from the Gulf of Corinth to the Gulf of Aegina in southern Greece. Its length is about 4 miles, a part of which was cut through soft granite rock and the remainder through soil. It has no locks. The bottom width is 72 feet and the depth 26¼ feet. The average tolls are 18 cents per ton and 20 cents for passengers.

No other canal in the world can rival the one at Sault Ste. Marie, Mich., which connects Lake Superior with Lake Huron, in the enormous volume of its shipping. There are really two canals — one owned by the Canadian Government, and one by the United States Government. The canal belonging to the United States was begun in 1853 by the State of Michigan, and opened in 1855. It had a length of about a mile and was provided with twin locks 350 feet long, allowing the passage of

vessels drawing 12 feet of water. The United States Government, by consent of the State of Michigan, began in 1870 to enlarge the canal, and, by 1881, had increased its length to 1.6 miles, its width to an average of 160 feet and its depth to 16 feet. A lock 515 feet long, 80 feet wide, and 17 feet deep was located south of the locks which were built by the State.

In 1882 the United States Government took over the entire control of the canal. Five years later the locks that had been built by the State were torn down, and a new one 800 feet long, 100 feet wide, and 22 feet deep was put into commission in 1896. The Canadian Canal, $1\frac{1}{8}$ miles long, 150 feet wide, and 22 feet deep, was built on the north side of the river during the years 1888 to 1895. Its locks are 900 feet long, 60 feet wide, and 22 feet deep.

The traffic through the Sault Ste. Marie Canals averages around 60,000,000 tons a year. This is as much as the Panama Canal can expect to get 40 years after its opening. The tonnage of the American Soo Canal passed the million mark in 1873, reached the 20,000,000 mark in 1899, and amounted to 46,000,000 net tons in 1909. It now ranges around 50,000,000 tons. It will be seen from this that the American Canal, built on the south side of St. Mary's River, gets about ten times as much traffic as the Canadian Canal, built on the north side of the river. This gives the American Soo Canal more than twice as much traffic as the Suez Canal, and about four times as much as the Panama Canal expects to begin with.

A canal which was built primarily for drainage purposes, but which seems destined to fill an im-

portant place as a traffic-carrying waterway, is the Chicago Drainage Canal connecting Lake Michigan at Chicago with the Illinois River at Lockport —a distance of 34 miles. It was built for the purpose of reversing the movement of water in the Chicago River and preventing the pollution of Lake Michigan. The sewage of the city now goes to the faraway Mississippi instead of the Lakes. The minimum depth of the canal is 22 feet, and its bottom width 160 feet. To complete the project the excavation of nearly 44,000,000 yards of material was required — enough, if deposited in Lake Michigan in 40 feet of water, to form an island a mile square with a surface 12 feet above the water. The city of Chicago and the State of Illinois have agreed to turn this canal over to the United States Government, if it will deepen the Illinois and Mississippi Rivers to 14 feet between Lockport and St. Louis. This would give a complete water connection from upper Mississippi River points to Lake Michigan, and open up a highway to the Gulf of Mexico. The estimated cost of this project is $25,000,000.

The completion of the Panama Canal will probably result in an unprecedented activity in the development of inland waterways in the United States. The new markets which it will open up to American products and the old markets it will stimulate and extend, will demand large additional facilities for getting the products of the American farm and factory to the seaboard. Already preparations for capitalizing the commercial opportunities which the opening of the canal will afford, are being made in various parts of the country.

The Erie Canal, connecting Buffalo and Albany and giving the Great Lakes a water outlet at New York, is being widened and deepened at an expense of $101,000,000. The propaganda of the American Rivers and Harbors Congress, looking to the appropriation of $500,000,000 to be spent in a systematic program of inland waterway development, is meeting with encouragement in every part of the country, and it is the expectation of those who believe that the Government should commit itself to such a program, that within 25 years the stimulus to waterway development given by the opening of the Panama Canal, will give to the United States one of the finest systems of inland waterways in the world.

CHAPTER XXX

A NEW COMMERCIAL MAP

THE most rapid change in the commercial map of the world wrought in centuries will be witnessed during the years following the completion of the Panama Canal. Cities that heretofore have been mere way stations on the international routes of trade will grow into rich centers where the new roads of the commercial world will cross. On the other hand, cities which in the past have gloried in a trade supremacy of international recognition will see themselves displaced and their prestige lost. The readjustment will not be the matter of a day or a year; even a generation may pass before it is completed; but the ultimate changes will certainly be greater and more world-encompassing than anyone now can forecast.

The capture of Constantinople by the Turks was directly responsible for the discovery of the New World. It cut off the cities of the Mediterranean from communication with India, and sent Columbus westward in quest of another passage, which could not be obstructed by the Mussulman tyrants of the East. At last the Panama Canal is to afford that passage, and to bring the whole earth into smaller compass.

Of course, the United States will be the first

to realize the great benefits of the canal. It will double the efficiency of the American Navy by permitting it to concentrate its forces on either ocean in shorter time, by weeks, than can be done by any other nation; consequently, it will add to American military prestige throughout the world. The benefits immediately accruing to the people of the United States will be as great in a commercial way as in military advantage. As the capture of Constantinople caused the upbuilding of many notable regions through the transformation of international trade routes, so will the completion of the Panama Canal open up new markets and new opportunities to the Mississippi Valley, the world's greatest granary. Its grain and meat products, loading by way of Gulf ports, can go to the ends of the earth with but little outlay for expensive rail transportation. It is even probable that the great awakening incident to the opening of the canal, may hasten the day when the Lakes-to-the-Gulf waterway will be an accomplished fact and when ships may load in Chicago, Detroit, Cleveland, St. Paul, and Minneapolis and sail directly to the ports of the world, thus beginning an era of commercial development surpassing even the wonderful growth of the half century just closed.

Pittsburgh may then be able to send its tremendous output of manufactures to all parts of the world without transhipment; Kansas City will feel the stimulus of the new waterway; and the Pacific coast, long cut off from the eastern section of the United States by high mountain barriers that have been only partially overcome

by railroads, will find its great resources within marketable distance of the Eastern States.

Canada, too, will feel the stimulus of the canal. No longer will its great crops have to find their slow outlet over railroads that must cross the backbone of a continent, but, pursuing the avenues of least resistance, they may move to all parts of the world by way of the Great Lakes and the Mississippi River.

South America will greatly benefit by the completion of the canal. Already its west coast countries and cities are getting ready for the boom of business that is to follow. Brought thousands of miles nearer to all western trade centers — so close that their raw products and American manufactured products can be exchanged to advantage — there will be a growth of trade whose prospect already has awakened the lethargic South American to the possibilities ahead.

These possibilities well may be considered by the business men of the United States. To-day North America buys a large percentage of the products of South America; but, when the South Americans have money to spare, they spend only $1 out of $8 in North America — the other $7 goes to Europe. The American exporter will find himself quickened by the history-making change the canal will produce and, if he goes at it in earnest, he will be in a position to reverse the present situation and get $7 of South American trade where Europe gets only $1.

Australia and New Zealand will experience, perhaps, a greater change in the trade routes than any other countries outside of the Americas.

The Australian commerce now is largely carried by way of Suez. The opening of the Panama Canal will place New Zealand 1,200 miles nearer to London than it is by way of Suez, and the eastern ports of Australia will be as near to England by way of Panama as by Suez. All Australasian ports will be brought several thousand miles closer to the Atlantic ports of the United States than they are to-day. No one who has heard an Australasian complain of the long delays and the excessive freight rates that intervene between him and his American shoes, can doubt that the closer proximity of American markets will be welcomed in that faraway land under the southern cross. Sydney will be 4,000 miles nearer to New York through the Panama Canal, and 5,500 miles nearer to New Orleans and Galveston.

The transcontinental tonnage now handled by the railroads, which ultimately will go by the canal, aggregates 3,000,000 tons a year. The seaboard sections of the United States, of course, will benefit more largely than interior points, for the reason that interior points will have to take a combined rail-and-water route. This will involve railroad transportation and transhipment of cargo, also rehandling charges. After the canal is opened it is probable that the railroads will prefer to supply the intermountain States directly from eastern sources, instead of maintaining the existing policy of giving low rates to Pacific coast cities, so as to give them dominance over the shipping business of the intermountain region. The total coast-to-coast traffic of the railroads is said to approximate one-fifth of the entire traffic

carried across the Rocky Mountains. Only one-third of the through traffic of the transcontinental lines from the East to the West originates east of a line drawn through Buffalo and Pittsburgh. It is this third of the westward business that will be affected mainly by the operation of the canal.

The principal effect the Panama Canal will have in the readjustment of the trade map of the world is not, perhaps, as much in changing exist-

INTERNATIONAL SHIPPING ROUTES

ing routes as in creating new avenues of business. In every region where there is promise of unusual benefit by reason of the opening of the Panama Canal, an effort is being made to capitalize the advantages to be derived therefrom. The west coast of South America feels the stimulus of suddenly being brought thousands of miles closer to the best markets of the world, and anyone who travels down the coast from Panama may see

at every port signs of a determination to reap full advantage of the new opportunities.

Even Guayaquil, a city that for years has been a hissing and a byword to the masters of all ships plying up and down the west coast because of its absolute indifference to all requirements of sanitation, has prepared for a campaign of cleaning-up, in order that it may become a port of call for all the ships passing that way. Heretofore, masters of ships, in order to comply with quarantine regulations elsewhere, have given it a wide berth whenever possible.

Chile, Peru, and Ecuador — all three have caught the spirit of the new era which a completed canal proclaims, and are striving to set their houses in order for the quickened times they see ahead. With the Central American Republics it is the same. Handicapped as they are by revolutions that sap their life-blood, or dominated by rulers who have no other object in governing the people than to exploit them, these countries still hope for much from the canal, and new activities are beginning to spring up in every one of them.

It is not improbable that the canal will play an important part in transforming the economic situation of the world during the generations immediately ahead of us. One needs only to study the distribution of humanity over the countries of the earth to find how unevenly the population is scattered, and to learn what great tides of immigration will have to flow westward to establish the equilibrium of population, which some day is bound to come. When Asia has a population of 50 per square mile and Europe a population of

100 a square mile, while North America has 15 and South America has 7, it is apparent that the future holds great changes in store. The potential development of the two Americas challenges the imagination. South America, with its virgin soil all but untouched, can support a population half as dense as that of Europe. This means that it can make room for 300,000,000 immigrants. Likewise, it is fair to assume that North America, with its up-to-date methods of agriculture, industry, and commerce, can support a population as dense as that of Asia with its primitive methods of manufacture and agriculture. This means that North America has room to accommodate 300,000,000 souls. In other words, room still remains for 600,000,000 persons on the continents which the Panama Canal divides. When the day comes, as it seems certain that it will, that the Americas reach their full growth, even the Panama Canal, larger by far than any other artificial waterway in the world, will be much too small to accommodate the traffic which naturally would pass its way.

The foreign trade of the United States with its 90,000,000 of population, aggregates 60,000,000 tons a year. Assuming that foreign trade would grow in the same proportion as population, it will be seen that the foreign trade of the two Americas at a time when the population of South America becomes half as dense as that of Europe, and that of North America half as dense as that of Asia, will approximate 500,000,000 tons. Assuming further that only one-fifth of this would pass through the canal, the American commerce

alone would exceed its capacity, leaving all the trade between the Orient and eastern Europe to be taken care of by future enlargements.

More immediate, however, will be the realization of the prophecy of William H. Seward, Lincoln's Secretary of State, that the Pacific is destined to become the chief theater of the world's events. As the population of the earth stands to-day, more than half of all the people who inhabit the globe dwell on lands which drain into this greatest of oceans. Yet, in spite of that fact, the trade that sweeps over the Pacific is but small in comparison with that which traverses the Atlantic. Where a thousand funnels darken the trade routes of the Atlantic, a few hundred are seen on the Pacific.

But in Japan one may find an example of the possibilities of the Pacific in the years to come. When China, with its 400,000,000 people, awakens as Japan has awakened, and builds up an international trade in proportion to that of Japan, it will send a commerce across the seas unprecedented in volume. When it buys and sells as Japan buys and sells, the waters of the Orient will vie with those of the Occident in the size of their fleets of commerce.

The opening of the Panama Canal promises to be one of the factors in hastening the day when the Orient will become as progressive as the Occident, and when sleeping nations will arise from their lethargy and contribute uncounted millions of tons of traffic to the Pacific Ocean, making it a chief theater of commerce as well as of world events.

In our own country the course of empire has been sweeping toward the Pacific. Where once the center of most things lay east of the Mississippi River, now we find its agriculture, its mining industries, and its commercial activities gradually moving westward. The center of cotton production, once in those States celebrated in the melodies of the Southern plantation, has moved westward and to-day in Texas, Oklahoma, and even Southern California, cotton is grown in a way which shows that King Cotton has caught the spirit of the age and is extending his territories westward toward the Pacific. And all of this means a growing business and an expanding traffic through the Panama Canal.

On the Atlantic side there are signs without number that many nations will be up and doing in the reformation of the commercial map of the world. The islands of the Caribbean form a screen around the Atlantic end of the canal, and the majority of them are British possessions. Many of their cities will be situated upon the new international trade routes that will be called into being by the opening of the Panama Canal. At Kingston, Jamaica, great improvements are projected, coaling stations are planned, and other steps are being taken which will enable the British Government to reap what advantage it can from the construction of the canal. With its splendid diversity of climate, brought about by the wide range of elevated land, the fruits of the temperate zones may be grown, as well as those of the Tropics, and, as John Foster Fraser expresses it, Jamaica may become the orchard of Great Britain.

Denmark is planning extensive shipping facilities in its beautiful harbor of Charlotte Amalia on the Island of St. Thomas. This island, which commands one of the principal passages from the Atlantic to the Caribbean Sea, might to-day be a possession of the United States had this Government been willing to buy it when Denmark was anxious to sell. It was here that the bold pirates of the *Spanish Main* hid their crews in the all but landlocked harbor, and waited for the shipping which passed through Mona passage. Here Bluebeard's castle still stands a mute reminder of the romantic days when buccaneers dominated the *Spanish Main*.

The north coast of South America also expects to figure largely in the new commercial map. The northern cities of Venezuela are on the route from eastern South America through the canal, and on one of the natural routes from Pacific ports to Europe. Nowhere else in the world will one find a more delightful climate or a more picturesque city or scenery than in northern Venezuela. Caracas, the capital, is but two hours' ride from the port of La Guaira, and less than a day's journey from Puerto Cabello, and, while the commerce which may be developed in Venezuela will, for the most part, find its outlet to the sea through the Orinoco River, La Guaira and Puerto Cabello will always prove attractive ports of call for passenger-carrying ships.

The changes in the commercial situation of Asia and the Americas, brought about by the opening of the canal, will be many. There will be a sudden

readjustment of existing trade routes and this will be followed by a long era of development of new conditions, which will be so gradual as to be almost imperceptible, and yet so immense as to excite the wonder of humanity when it stops to reckon its full effect and meaning.

CHAPTER XXXI

AMERICAN TRADE OPPORTUNITIES

THE great development of the southern part of the New World, extending from the Rio Grande to the Strait of Magellan, certain to take place as a result of the opening of the Panama Canal, spells opportunity for American commerical expansion. This vast territory, covering an area nearly three times as great as that of the United States, has a population of only 50,000,000. Its resources have been merely scratched on the surface. Its potentialities, acre for acre, are as great as those of the United States.

Porto Rico will serve for a criterion by which to measure the future possibilities of this Empire of the South. In Porto Rico one may see the benefits of the institution of a really good government, and the success which attends a proper effort to develop natural resources in tropical America. If American opportunities in all Latin America may be measured by American successes in that island, then, indeed, the future is rich with promise. During a single decade the external commerce of this little gem of the West Indies was more than quadrupled. It now amounts to some $80,000,000 a year, and only about 12 other countries in the world buy more goods from the American manufacturer.

The expansion of internal business has kept pace with the growth of external commerce. In seven years taxable values increased from less than $90,000,000 to more than $160,000,000. In a single year the amount of life insurance written in the island nearly doubled, and fire insurance increased nearly half. The exportation of sugar increased fivefold in 10 years, and the exportation of cigars 14 times. The population of the island has increased by half under the beneficient policies of the United States, going up from 800,000 in 1898 to 1,200,000 in 1912. During a single year Porto Rico buys about $35,000,000 worth of goods from the United States, and ships practically the same amount to this country.

Should all Latin America prove as good a customer in proportion to area as Porto Rico, our trade with Latin America alone would be many fold greater than the entire foreign trade of the United States to-day. Should all Latin America, even with its present population, buy as liberally from the United States as Porto Rico does, we would sell annually to it nearly $2,000,000,000 worth of products.

The most necessary step in developing the potentialities of Latin America is to provide good and stable government. Commercial statistics show how prosperity flourishes where good government reigns, and of how poverty dwells where misgovernment exists. One may go to Porto Rico, to Jamaica, to Curacao, or to St. Thomas, and in each of these countries may behold the wholesome rule of northern Europeans and their descendants. The people have at least those sub-

stantial rights which are necessary to the peace, happiness, and well-being of humanity; and equally without exception trade statistics show a greater foreign trade, in proportion to area and population, than is enjoyed in any country where misrule prevails. Porto Rico could be buried in a single lake of Nicaragua; it is only one-fifty-seventh as large as Central America; and yet Porto Rico has a foreign trade greater than all the territory from the Isthmus of Tehuantepec to the Isthmus of Panama.

How to improve governmental conditions in those countries where misrule prevails is a most serious problem. Had it not been for the Monroe doctrine it is safe to say that not one of the Republics of tropical America would be in existence today. Instead, their territory would be colonial possessions of the several powerful nations, and their people would be living under the comparatively wholesome rule of those nations. As it is, in a majority of the Republics south of the Rio Grande there is a state of affairs which makes against the development of resources and the best interests of the people. The whole theory under which these countries are governed is that primitive one: "Let him take who has the power, and let him keep who can." The result is that they are Republics only in name, and that the only way to change administrations is to have a revolution. Revolutions mean poverty; poverty means undeveloped resources, and so in some of these countries conditions were as bad in 1913, after nearly a century of so-called republican rule, as they were when the yoke of Spain was thrown off in 1821. How to bring about those conditions

of peace and amity essential to national growth and development in these countries is the problem that has vexed more than one administration in Washington.

Some have answered that the best way to do it is to abrogate the Monroe doctrine and to let every Latin American tub stand on its own bottom, a proposal that might benefit these countries vastly, but which contains many possibilities of evil to the United States. Others have suggested that our experiment in Porto Rico offers the solution of the problem, at least so far as tropical North America is concerned. They assert that the end would justify the means, and that the planning of the same character of government in this territory that exists in Porto Rico today, would be the greatest godsend that the masses of the people of these countries could have. Still others have advocated a "hands-off" policy so far as the rule of these countries is concerned, allowing them to fight whenever, and in whatever way, they wish, but at the same time adhering rigidly to the Monroe doctrine against European interference.

Whatever the ultimate conclusion, it seems useless to hope for prosperity and expansion in countries whose industries constantly suffer from the galling blight of ever-recurring revolution. The great problem that lies before the American people, if the Latin America of the future is to become like the Anglo-Saxon America of today, is that of devising a policy which will insure conditions of peace and good will in the several sword-ruled countries south of the Rio Grande.

As matters stand today in the majority of the countries of Latin America, although their Governments owe their very existence to the United States, there is a feeling of antipathy against Americans, which places the American exporter on an unequal footing with his European rival. There is a prejudice against Americans, partly the result of a widespread feeling that the United States is the great land-grabber of the Western world, but mostly the result of the attitude of a large number of Americans who go into these regions. For instance, for years one could not go about the streets of Mexico City without hearing some American berating the "blankety blank greasers," and asserting that the United States could take 5,000 men and capture Mexico City in a two-month campaign. It happens that the Mexican is a proud individual and naturally he bitterly resents such asseverations.

The same is true elsewhere, and by personal contact prejudice rather than a feeling of friendship has been aroused. The European usually goes into these countries because there are few opportunities at home. He is usually representative of the best citizenship of his homeland, and quite as much the gentleman in Latin America as at home. While there are a great many splendid types of American citizenship scattered throughout Latin America, a greater number of people have gone there because they could not get along in the United States, and their hostile attitude toward the natives excites by far more prejudice than the better class of Americans can counteract by sympathy and good feeling. Americans who

visit these countries expressing contempt for everything they see, and everything the people do, are the greatest hindrances to the realization of the commercial opportunities which the United States possesses in Latin America.

If the manufacturers of the United States are to realize to the full the benefits which may be derived from the opening of the Panama Canal they will have to reform their methods of dealing with the Latin Americans. It is just as effective to send to buyers at home catalogs written in Greek or Sanscrit as to send to the majority of Latin Americans catalogs printed in English. In traveling through these countries, endeavoring to ascertain wherein Americans have failed in their efforts to get a proper share of their foreign trade, one hears on every hand the complaint that the American manufacturer seldom meets the conditions upon which their trade may be based. No satisfactory credits are given, and no effort is made to manufacture machinery fitted to their peculiar needs. Agricultural machinery, for instance, which may serve admirably in the United States, is wholly out of place in many of these countries; and yet the Latin American customer must either buy the surplus of these machines or go elsewhere for machinery built to answer his requirements.

The European traveling salesman in these countries carries a line of goods immediately answerable to local requirements. Furthermore, the European exporter understands that the system of credits in Latin America is not the same as prevails in Europe and the United States,

and he complies with their requirements. Of course, his prices are placed high enough so that he is nothing out of pocket for the seeming concessions he had made. The result is that in traveling in these countries, one meets three or four foreign "drummers" where he meets one American traveling man, in spite of their nearness to the United States. It will take years, even with the Panama Canal in operation, to overcome the disadvantage which bad business policy has placed upon the American manufacturers.

If the opening of the Panama Canal spells new American commercial opportunities, it also develops a new field of international politics in which the United States must make itself the dominant factor, and in which it will have a transcendental interest. It will unquestionably give to the Monroe doctrine a new importance and render its maintenance a more urgent necessity than ever. Prior to this time the breaking down of the Monroe doctrine would have been greatly detrimental to the interests of the United States, but from this time forth the domination of the Caribbean by some other strong nation would likely prove most disastrous to American welfare. It might even lead to the loss of the canal itself, and we then would witness that great waterway transformed from a military asset of immeasureable benefit into a base of operations against us.

Probably the chief danger to which the Monroe doctrine is exposed is from those countries whose rulers profit most by its enforcement. While the United States can control its own affairs in

such a way as not to bring into question this doctrine, it is not so certain that the rulers of some of the Latin American nations will always do as well. In fact, some of the countries have conducted their affairs in such a way as might have involved the United States in a war with a foreign power. The knowledge that a small tropical American republic might act so as to force the United States into a critical situation has resulted in a desire on the part of the responsible authorities at Washington to exercise over the Republics of the Caribbean such a guiding control as would serve to prevent them, through any ill-considered or irresponsible act, from exposing the United States to dangerous controversies with foreign nations.

For instance, here is a country which owes a large debt to British bondholders. It defaults on the interest for a period of years. Efforts to collect are futile. Finally it is decided by the President that he needs additional funds. He reaches an agreement with the representatives of the bondholders, by which they agree to refund the debt and to lend him an additional half a million dollars, upon the condition that he hypothecate the Government's export tax upon coffee to secure the amortization of the refunded debt. He does so. Matters move along quietly for a little while, but soon he needs additional funds. He negotiates with New York bankers, getting from them the funds he needs, and hypothecates with them the same coffee tax that he had hitherto hypothecated with the British bondholders. Of course, the British bondholders protest at this

impairment of their securities. He laughs at their protest. England sends a warship to his ports. He appeals loudly to the United States for the maintenance of the Monroe doctrine; but the United States does not hear him, so he decides to treat the British bondholders fairly. If he had not done so, and England had been seeking to break down the Monroe doctrine, an ideal opportunity would have been afforded.

It is to prevent such situations as these that many Americans hope that the Government may devise some plan that will at once protect the United States from such menaces, and at the same time allow the people of these countries to work out their own destiny in their own way.

The situation in tropical America today, with a few exceptions, seems to be that the republics have the form of liberty without its substance, and the shadow of civilization without its realities. Some of them have had over fifty revolutions in as many years. Some of them have been in the grip of tyrants who were as heartless in exploiting their people as was Nero in ruling Rome. The masses have received nothing from the Government except oppression, and they live in that hopeless, heartless ignorance so well described by a Spanish writer, picturing conditions in Porto Rico before the American occupation. We know that this picture was a true one. It was drawn in 1897 and won the prize awarded by the Spanish Government at the centennial celebration of the retirement of the English from this island. After dilating upon the splendors and magnificence of Porto Rico, this artist of the pen said of the masses:

"Only the laborer, the son of our fields, one of the most unfortunate beings in the world, with the pallid face, the bare foot, the fleshless body, the ragged clothing, and the feverish glance, strolls indifferently with the darkness of ignorance in his eyes. In the market he finds for food only the rotten salt fish or meat, cod fish covered with gangrenish splotches, and Indian rice; he that harvests the best coffee in the world, who aids in gathering into the granary the sweetest grain in nature, and drives to pasture the beautiful young meat animals, can not carry to his lips a single slice of meat because the municipal exactions place it beyond his means, almost doubling the price of infected cod fish; coffee becomes to him an article of luxury because of its high price, and he can use only sugar laden with molasses and impurities."

That picture applies to more than 90 per cent of the people in tropical America to day. It explains why these countries, which might be made to flow with the milk and honey of a wondrous plenty, are poverty-stricken and unable to work out a satisfactory destiny for themselves. It shows why Cuba, Porto Rico, and Jamaica to-day are rich in internal trade, and prosperous in foreign commerce, while other countries are eking out a bare and scanty existence.

American commercial opportunities around the Mediterranean of the West, in particular, and in Latin America, in general, will reach their full when government there becomes government for the welfare of the people rather than for the aggrandizement of the ruling class.

CHAPTER XXXII

THE PANAMA-PACIFIC EXPOSITION

WHEN, on February 20, 1915, the Panama-Pacific International Exposition opens its gates to the world, in celebration of the completion of the Panama Canal, it expects to offer to the nations of the earth a spectacle the like of which has never been equaled in the history of expositions. It is estimated that $50,000,000 will be spent in thus celebrating the great triumph of American genius at Panama. And those who know the spirit of the people of California, who are immediately responsible to the United States and to the world for the success of the undertaking, understand that nothing will be overlooked that might please the eye, stir the fancy, or arouse the patriotism of those who journey to the Golden Gate to behold the wonders of this great show.

The spirit that was San Francisco's following the terrible calamity of April 18, 1906, when the city was shaken to its foundations by a great earthquake, and when uncontrollable fire completed the ruin and devastation which the earthquake had begun, has been the spirit that has planned and is carrying to a successful culmination the Panama-Pacific Exposition. The San Francisco earthquake came as the most terrific

blow that ever descended upon an American city. It left the metropolis of the Pacific a mass of ruins and ashes. In five years a newer and a prouder San Francisco arose from the ashes of the old, and greeted the world as the highest example of municipal greatness to which a community can rise at times when nothing is left to man but hope, and that hope is half despair.

The fire destroyed 8,000 houses, leaving such a hopeless mass of débris that $20,000,000 had to be raised to reclaim the bare earth itself. In five years 31,000 finer and better houses had taken their places. Assessed values before the fire were $30,000,000 less than five years after. Bank clearings increased by a third and savings-bank deposits were greater after only five years than they were before the terrible catastrophe.

It may be imagined what wonders this spirit of the Golden West will accomplish when applied to the creation of an exposition. It is easy to forecast that, beautiful as have been the expositions of the past, and magnificent as has been the scale upon which they were planned, fresh palms will be awarded to San Francisco and the great fair it will offer to the world in 1915.

The city of the Golden Gate was planning a great celebration nearly two years before the calamity which overtook it in 1906. The first suggestion for holding a world's fair at San Francisco was made on June 12, 1904, when Mr. R. B. Hale wrote a letter to the San Francisco Merchants' Association advising its members that it would be wise to take steps toward securing for that city a great celebration of the 400th anni-

versary of the discovery of the Pacific Ocean, in 1913. The matter was agitated for a year and a half and, a little more than three months prior to the earthquake, Representative Julius Kahn introduced in the National House of Representatives a bill providing for the celebration of the discovery of the Pacific, in 1913. Then followed the great catastrophe, and for the eight months next ensuing the problems of planning a new and greater San Francisco demanded all the attention of the people of that city. In December, 1906, however, the Pacific Ocean Exposition Company was incorporated with a capital stock of $5,000,000.

By 1910 New Orleans had loomed up as an aspirant for the honor of holding the great international celebration of the completion of the Panama Canal, and San Francisco understood that time for action was at hand, and, moreover, that money raised at home for the exposition would be the most eloquent advocate before Congress. Realizing this, a great mass meeting was called and in two hours subscriptions amounting to $4,089,000 were raised, headed by 40 subscriptions of $25,000 each.

In the fall of that year San Francisco was afforded an opportunity of attesting the universality of its interest in the success of the exposition. A proposition to vote $5,000,000 worth of bonds for the exposition was referred to the people. It carried by a vote of 42,040 to 2,122. The State of California also gave its citizens an opportunity to show their feeling, and by a vote of 174,000 to 50,000 made available bonds for $5,000,000 for

the purposes of the exposition. The result has been that from first to last, within the confines of California's borders, a sum approximating $20,000,000 has been raised for exposition purposes. To this, $30,000,000 will be added by outside governments and by exhibitors and concessionaires.

The fight which led to the choosing of San Francisco as the city for holding the Panama celebration is, for the most part, familiar history. The law under which this choice was made was signed by President Taft on February 15, 1911. The presidential signature was the signal for the beginning of operations looking to the completion of all of the exposition buildings a full six months ahead of the opening date. The details of the site were worked out promptly. The site selected includes the western half of Golden Gate Park; Lincoln Park, which is situated on a high bluff overlooking the approach from the Pacific Ocean and the Golden Gate; and Harbor View, which is an extensive tract of level land, stretching along the shore of San Francisco Bay and back to the hills and the principal residential portion of the city.

Each element in this extensive site possesses its own peculiar charm; Golden Gate Park with its great variety of flowers and semitropical plants and trees; Lincoln Park with its outlook on the broad Pacific and along the rugged coastline to the north; and Harbor View with the Golden Gate to the left, a chain of climbing hills across the harbor in front, and the long sweep of bay and islands to the right. What nature has

not done for the site of the exposition will be done by the art of the landscape gardener.

An ocean boulevard, to be made one of the most beautiful drives in the world, will become one of the permanent memorials of the exposition. A great esplanade, planted with cypress and eucalypti and liberally provided with seats, will extend along the water's edge for about half the entire length of the exposition grounds, affording ample opportunity for the thousands of visitors to watch the great water events which will constitute one of the features of the exposition. On the south side of this esplanade the principal exposition buildings, consisting of eight great palaces, will be located. A great wall, 60 feet high, will be built along the northern and western waterfronts for the purpose of breaking the winds which sweep down the harbor, and will be continued around the other two sides of the exposition grounds proper so as to constitute a walled inclosure which, in appearance, will remind one of the old walled towns of southern France and Spain.

The two principal gateways to the exposition grounds will open into great interior courts, around which the buildings will be ranged. It will be possible for the visitor to go from one building to another and complete the entire circuit of eight main exhibition palaces without once stepping from under cover. The three largest courts are named: The Court of the Sun and Stars, the Court of Abundance, and the Court of the Four Seasons. The Court of Abundance represents the Orient, and the Court of the

Four Seasons, the Occident; the Court of the Sun and Stars, uniting the other two, will typify the linking of the Orient and the Occident through the completion of the Panama Canal. There will also be two lesser courts, known as the Court of Flowers and the Court of Palms. Outside of the walled city there will be five other important exhibition palaces.

The Panama-Pacific Exposition will be different from any that has gone before. Where others have been built on broad, level plains, this one will be located in one of nature's most beautiful natural amphitheaters, with the residential portions of San Francisco and the towns of the surrounding country looking down upon it. The architecture will be of such a nature that will make the "Fair City" indeed a fair city to behold.

If Chicago had its "White City," the San Francisco fair will be all aglow with rich color. It will be made to harmonize with the "vibrant tints of the native wild flowers, the soft browns of the surrounding hills, the gold of the orangeries, the blue of the sea." The artist in charge of this phase of the work declares that, "as the musician builds his symphony around a motif or chord," so it became his duty to "strike a chord of color and build his symphony upon it." The one thing upon which he insisted was that there should be no white, and the pillars, statues, fountains, masts, walls, and flagpoles that are to contrast with the tinted decorations are to be of ivory yellow. Even the dyeing of the bunting for flags and draperies is under the personal

supervision of the artist in charge of the color scheme of the exposition. The roofs of the buildings will be harmoniously colored and the city will be a great party-colored area of red tiles, golden domes, and copper-green minarets. "Imagine," said Jules Guerin, the artist, "a gigantic Persian rug of soft melting tones with brilliant splotches here and there, spread down for a mile or more, and you may get some idea of what the Panama-Pacific Exposition will look like when viewed from a distance."

The lighting of the exposition will be by indirect illumination, affording practically the same intensity of light by night as by day. Lights will be hidden behind the colonnades, above the cornices, and behind masts on the roofs. Sculpture will stand out without shadow at night as by day. Great searchlights, many of them concentrated upon jets of steam, and playing in varying color, will add to the beauty of the scene. Even the fogs of the harbor will be made to contribute to the night effect of the exposition, and auroras will spread like draped lilies in the sky over the exhibition.

The sculpture will be unique in the history of exposition-giving. That phase of the work is under the control of Karl Bitter. In front of the main entrance, at the tower gate, there will be an allegory of the Panama Canal called "Energy; the lord of the Isthmian way." It will be represented by an enormous horse standing on a heavy pedestal, the horse carrying a man with extended arms pushing the waters apart. In the Court of the Sun and Stars two great sculp-

tural fountains, typical of the rising and setting of the sun, will carry out the idea of "the world united and the land divided." In every part of the exposition scheme the sculpture will tell the story of the unification of the nations of the East and the West through the construction of the Panama Canal.

Nothing seems to have been overlooked in the plans that have been made to celebrate the opening of the Panama Canal at San Francisco. There will be a working model of the Panama Canal, with a capacity of handling 2,000 people every 20 minutes. A reproduction of the Grand Canyon of Arizona will be another feature. The liberality of the prizes offered is indicated by the fact that premiums in the live-stock exhibits alone aggregate $175,000.

One of the greatest events of the exposition will be the rendezvous of representative ships from the fleets of all the nations of the earth in Hampton Roads in January and February, 1915. Their commanders will visit Washington and be received by the President. He will return with them to Hampton Roads and there review what promises to be the greatest international naval display in history. After this a long procession of fighting craft, perhaps accompanied by an equally long procession of tourist steamers, private yachts, and ships of commerce, will steam out of the Virginia Capes and turn their prows down the Spanish Main to Colon. Here the canal authorities will formally welcome the shipping world and pass its representatives through to the Pacific, whence they will sail to San Fran-

cisco, there to participate in the great celebration during the months which will follow. It may be that this great procession will be headed by the U. S. S. *Oregon*, whose trip around South America in 1898 proclaimed in tones that were heard in every hamlet in the United States the necessity of building the great waterway.

In addition to the great exposition at San Francisco, another will throw open its gates during 1915 — the Panama-California Exposition at San Diego. This exposition will be held at a total outlay of, perhaps, $20,000,000. Nearly $6,000,000 is being spent on a magnificent sea wall. The San Diego and Arizona Railway is being built on a new and lower grade for nearly 220 miles. About $5,000,000 will be spent in making the exposition proper in Balboa Park. Over 11 miles of docks and a thousand acres of reclaimed land for warehouses and factory sites will be ready when the exposition opens on January 1, 1915. The fair will have 30 acres of Spanish gardens. A great Indian congress and exhibit will be held, representing every tribe of North and South America. This exposition will in nowise interfere with the big show at San Francisco, but will be supplemental to it.

When the Suez Canal was finished, its opening was celebrated by the most magnificent fete of modern times, the profligate Khedive Ismail Pasha apparently endeavoring to outdo the traditions of his Mussulman predecessors, Haroun al Raschid and Akbar. The fete lasted for four weeks, Cairo was decorated and illuminated as no city, of either Occident or Orient, ever had

been before. The expense of the month's carnival was more than $21,000,000.

An opera house was built especially for the occasion, and Verdi, the famous Italian composer, was employed to write a special opera for the occasion. That the opera was "Aida," and that it marked the high tide of Verdi's genius, was perhaps more than might have been expected of a work of art produced at the command of an extravagant prince's gold.

The canal itself was opened on November 16, 1869, a procession of forty-eight ships, men of war, royal yachts and merchantmen, making the transit of the Isthmus in three days' time. In the first ship was Eugenie, Empress of the French. In another was the Emperor of Austria, and in still another the Prince of Wales, afterwards Edward VII. A more imposing gathering of imperial and royal personages never before had been witnessed, and all of them were the Christian guests of the Moslem Ismail.

When the procession of royal vessels had passed through, the captains and the kings went to Cairo for the fete. The canal was open for traffic. It was significant that the first vessel to pass through in the course of ordinary business, paying its tolls, flew the British ensign. The building of the canal had wrecked Egypt, financially and politically; was destined to end forever the hope of Asiatic empire for France; and was to make certain England's dominion over India, a thing de Lesseps and Napoleon III had intended it to destroy.

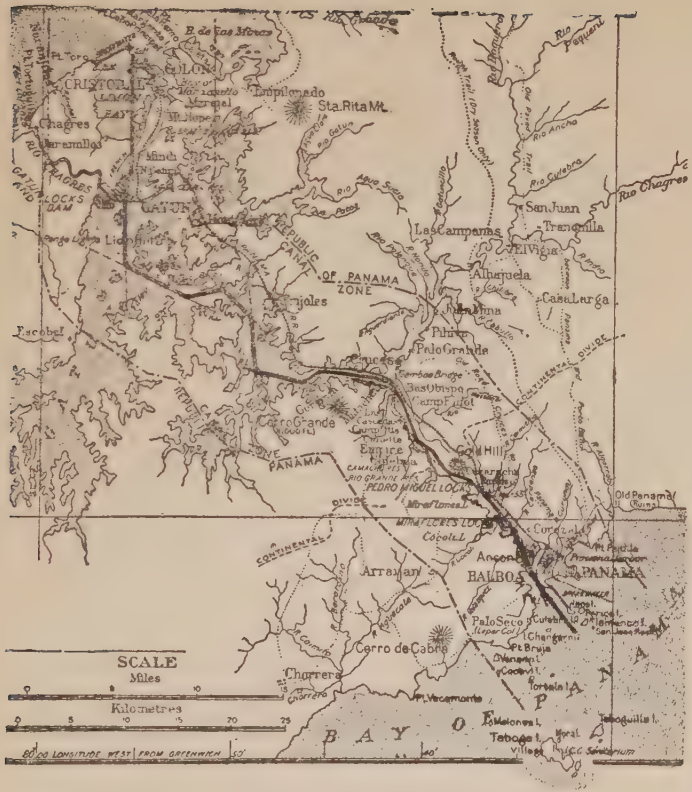
The celebration of the completion of the Suez

Canal was the wildest orgy of modern times, the last attempt to Orientalize a commercial undertaking of the Age of Steam and Steel.

The celebration at San Francisco will be more magnificent in its way, and will cost more money. But the millions will not be thrown away for the mere delectation of the senses of two score princes — they will be expended for the entertainment and the education of millions of people, the humblest of whom will have his full share in the celebration.

From the spruce woods of Maine, from the orange groves of Florida, from the wide fields of the Mississippi Valley, from the broad plains of the Colorado, from the blue ridges of the Alleghenies and the snow peaks of the Rockies, Americans will go to the Golden Gate to commemorate in their American way the closer union of their States, the consummation of the journeys of Columbus: The Land Divided — the World United.

THE END



A MAP SHOWING THE ISTHMUS WITH THE COMPLETED CANAL

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